Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

*CIRCULATION STATEMENT*

*During* 1910 *we printed and circulated* 526,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

*Our circulation for July,* 1911, *averaged* 9800 *copies per issue.*

| | |
|---|---|
| *August* 5 | 10,500 |
| *August* 12 | 9,500 |
| *August* 19 | 9,500 |
| *August* 26 | 9,500 |

*None sent free regularly, no back numbers. Figures are live, net circulation.*

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# The Engineering and Mining Journal

Vol. 92. AUGUST 26, 1911. No. 9

## Trade Secrecy

The request for a description of the headframe of a Colorado mine recently brought back the reply that the manager permitted no descriptions of the property to be written. What an epitome of narrowness and selfishness! That such a policy is not an essential to success is shown by such men as Doctor Ricketts, Doctor Douglas, James Gayley, and the late Charles F. Shelby, who have always been willing to spread their knowledge before others. And if men controlling such interests as they do are able without prejudice or injury, to disseminate technical information, it seems as though some of the secretive small fry could pattern by them to the benefit of all concerned.

Apart from any consideration of the selfishness and stinginess of this policy, it seems short-sighted from a mere business standpoint, since writing is a good form of advertising. To this may be added the consideration that if a man's competitors wish information about his works they will get it, and will get just as much as they please, and this condition will remain as long as employees will move for larger salaries. The result of the no-publication policy is, therefore, that competitors get the information, while those in non-competing technical lines do not.

On this last ground there is the broad ethical consideration that all engineers should be apostles of conservation of energy and material, and that the spread of information of which the secrecy is not absolutely necessary should be no less an obligation on the engineer than the Aesculapian oath is on the physician. Of course, we recognize that certain information is vital to companies, and should be kept secret as long as possible, although as said above, the competitors who need the information will probably get it.

So until the day comes when all plants work in the absolute perfection of safety and economy, when all costs are at a minimum, and there is no quality but the best, we wish to give honor to those whose ideal is the diffusion of knowledge among men, and to point out for contempt the intellectual miser who wishes to get information but to give none.

## The Metallurgy of Zinc

During the last few years the metallurgy of zinc has experienced no especially remarkable improvements, but much attention has been devoted right along to the perfection of details, and these have resulted in reduction of operating expense and increase in metal recovery. None of these improvements has, however, involved anything radical. The conditions do not seem to permit the introduction of any great novelty. Thus in the matter of charging machines, it is entirely feasible to apply them, but they are necessarily cumbersome, and the economy gained has not yet been found to be sufficient to justify the installation.

Some persons have advocated the charging of briquets instead of the "loose charging" method commonly employed. This proposal looks attractive theoretically, but its advocates seem to forget that there is nothing very new in the idea, and that previous trials have not led to results leading to its common adoption.

Many persons inexperienced in zinc smelting, looking into it as a new thing, are inclined to speak of it as a backward art, capable of enormous improvement. As we have previously pointed out many times, however, the practice of zinc smelting is not in fact backward, but on the contrary is pretty well developed, considering that the zinc smelter deals with a concentrated product, analogous to high-grade lead or tin concentrates. In modern practice the loss of metal is not excessive, nor is the cost of performing the process extravagant. The zinc smelter is moreover capable of treating commercially a wide range of ores. The deleterious impurities, especially lead and iron, no longer cause the trouble that once they did.

A great deal of experimental work has been done upon the electrothermic smelting of zinc ore. Among others, such work has been done by Thomson and Fitzgerald, at Niagara Falls, N. Y., and at Hohenlohehütte, Germany; by E. Ferraris, in Sardinia; by Hermann Pape, in Germany; by W. McA. Johnson, at Hartford, Conn.; by Louvrier and Louis, in France; and by C. P. G. de Laval. Electrically smelted spelter has been produced by the De Laval process in Scandinavia, for five or six years, but until recently, at least, it has been the result of repeated resmeltings. In the direct smelting of ore all experimenters have been troubled by the excessive production of blue powder, and for various reasons the process has not been a commercial success, not even under the most favorable conditions of cheap power and labor. Recent information is to the effect that electric zinc smelteries are in operation at Trollhätten, Sweden, and Sarpsborg, Norway, using about 7000 and 4000 h.p. respectively, and it is claimed that they are now producing spelter from ore instead of from dross, and waste products, as formerly. Anyway, they are certainly receiving ore and turning out spelter. As to the commercial results of the operation and in fact as to all details, information is lacking.

Aside from what may have been accomplished in Scandinavia, however, the electric smelting of zinc ore is, in spite of all claims to the contrary, not only still in the experimental stage, but is in the infancy of the experimental stage. Even if the metallurgical difficulties can be overcome, which is possible, we are inclined to think that no one is yet in a position to make any reliable estimate of commercial advantage or commercial results in any way unless it be the engineers in charge of the operations at Trollhätten and Sarpsborg.

## The Situation in Spelter

When the European convention was renewed, not long ago, as in fact when it was first formed, the predominant idea was to remove the danger of an excessive production. Consequently all the measures that were debated were of restrictive character. Nobody seemed to think that in the near future there might fail to be sufficient productive capacity. Yet, as if to prove the incapacity of human forethought the demand has risen in a relatively brief period to such an extent as to refute all preconceived ideas and for some time Europe has been facing a shortage of spelter. The selling agencies have had not to try to keep up the price but to keep it down. In this they have pursued a very wise and far-sighted policy, recognizing the danger of such a runaway market as occurred five years ago in copper.

The extraordinary strength of the spelter market in Europe is based on the large demand for consumption, reflecting the marvelous industrial activity in Great Britain and Germany, especially. It constitutes a strong underpinning for our domestic spelter market, because if conditions should lead to any tendency toward recession here Europe would be glad to relieve us of any surplus at a very handsome price. Certainly it does not appear as if American zinc producers have now any legitimate ground for complaint.

## Over-Precipitate Improvements

One of the most objectionable features in showing visitors through a manufacturing plant is the amount of gratuitous advice given. Several years ago we recollect that when a party of technical visitors was shown through a large copper refinery one member immediately wished to install an improved flue-dust condensing apparatus, another was sure that the Whitehead slimes-treatment process (which had formerly been the one in use), was superior to the method used, while a third wished to cant the multiple electrodes, because he had understood it reduced metal losses in the series system. Another case was that of an opencut mine in soft ground in Nicaragua, where the whole system of working allowed for the facts that there were 130 in. of rainfall per year and that it practically all fell at night, but where every visitor immediately suggested better methods, based on hard-rock work, and the assumption that a cut dry at night would not receive a Noachian deluge before morning.

These are, perhaps, exaggerated examples, but there is often the tendency of a management to make changes regardless of conditions. That certain railroads have been run too much from New York is patent. That some mines and metallurgical plants are run that way is a matter of strong suspicion. That it is best to get the viewpoint of the man who does the work before making changes is a postulate not lightly to be dismissed.

The delicate question then is, how far is the individual's judgment based on facts, and how far is it simply a function of mental inertia. A great copper smeltery refused for many years to use the casting wheel, because its men said the bars would not be as smooth as the hand cast. Before copper was first poured, the Welsh furnace men said that copper could not be run from a furnace, but must be ladled, as their fathers had done it. The point then is, that having got the opinion of the man on the job, and decided that his objections are the result of ingrowing habits, make the change, bearing also in mind that sometimes the man who bites twice to a cherry can eventually eat more cherries than the man who bites once.

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An esteemed daily contemporary informs us that the production of coke in the United States is equal to "two-thirds of the total production of bituminous and anthracite coals together." This is a clear case of superfluity of words; if anthracite only had been named, it would be near the truth. The same authority speaks of coke as "the byproduct of the gas and steel industries"—again using a superfluous word. Some coke is produced as a byproduct of the gas industry; but in the steel industry we are under the impression that coke is an indispensable raw material or fuel, not by any means a byproduct. The writer adds that members of the general public "understand little of the great bituminous industry, and they know less of coke"—which is evident in his own case.

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The National Conduit and Cable Company, an extensive manufacturer of copper, which, for a long time, has been pessimistic as to the price for copper, has come out with the recognition that copper at less than 13c. is cheap, and advises buyers not to hold off too long. This is a refreshing indication that American manufacturers, who have been notoriously bad buyers, allowing the Europeans to secure the cheap copper while they covered their own requirements on a rising market, may be awakening to the advantage of a different policy.

# Correspondence and Discussion

## The Efficiency of Fine Grinding Machinery

I have read with a great deal of interest the article by Walter H. Urbiter on the efficiency of fine-grinding machinery, in the JOURNAL of Aug. 5. In connection with Mr. Urbiter's data I should like to make a few comments on the chilean mills at the Santa Elena hacienda, described in my article in the JOURNAL of Nov. 12, 1910, and to which Mr. Urbiter refers.

Two of the mills are, as Mr. Urbiter notes, of modern make and are of the kind manufactured within the last twenty years. The other two, I have reason to believe, are much older, the principal difference being that with the older machines the screen frames are inside the mill so that the mill has to be stopped whenever screens are to be changed. The others have the screen frames outside and new ones can be put in place in a few minutes without stopping, as an extra frame with screen is always kept ready for emergencies. Both types, however, are defective in that the oiling arrangement is so placed that the mills have to be shut down once every 24 hr. to fill the oil and grease cups on the crushing wheels. This is an item that could be easily arranged correctly, but it has not been done up to this time.

The slow chilean mill, as a primary crushing machine, has advantages, as pointed out by Mr. Urbiter, that to an open-minded person can hardly fail to appeal. It can be kept running steadily for lengths of time that can never be approached by stamps, and the consumption of power and expense items are much less than with either stamps or fast chileans, to say nothing of the favorable product; that is, in fineness. I am inclined to think that its merits are not more favorably known because the machine has been out of use for many years and the later operators have had few opportunities to see it at work and appreciate its advantages. To work with these mills is a revelation to one who has been accustomed to stamps, where the changing of shoes, dies and screens is incessant, or with the fast chilean, where the wear is excessive and breakages likely to occur at any time.

It must be remembered, too, that the chilean mill is older than stamps, practically so even in its present form of two rollers and slow speed, so that the stamp mill can hardly be referred to as the "Old Timer," but belongs rather to the middle age of milling.

Of course, it would be folly to advocate the use of the chilean mill in any form to all ores, for there is no one machine yet made, not even stamps, which will give good results on any ore, but the places where the stamps could not be replaced to advantage by slow-speed chileans are, to my mind, few and far between. One fact, however, is important, the slow-speed mill will not regrind. The sand returned to such a mill for regrinding will pack on the ring like a macadam road, and the wheels will keep rising as the sand packs down. There is almost no efficiency. A small percentage of sand can be returned to the mill with the coarse ore, but at the expense of efficiency. I have found the mill most efficient with a large quantity of water, or solution, in order to take away at once the material which is fine enough to get through the screen. Even in this case the proportion of slime is great, as noted in my paper. In conclusion I know of no better words to express my preference for the old slow-speed chilean than those applied by Mr. Urbiter to stamps at the conclusion of his article.

HERBERT A. MEGRAW.

San Luis Potosi, Mex., Aug. 14, 1911.

**Views, Suggestions and Experiences of Readers**

## Steel Headframe for Small Mines

While steel headframes have been built for a number of mines in this and other countries, it is a foregone conclusion that a timber structure will succeed the hand- or horse-whim when development work on a prospect has been done to such an extent that a mechanical hoist is required. The steel headframe is, at present, considered only when mining is to be done on a large scale—a scale that calls for such a structure shortly after the prospect becomes a mine, or the quantity of ore to be hoisted at a producing mine is increased to such an extent as to make a new headframe absolutely necessary. At some mines a steel headframe has been built to avoid the possibility of another fire such as destroyed the original timber structure. At other mines, the tonnage of ore raised has been so largely increased that the old headframe was inadequate, and steel was used for the new headframe because one of timber would be cumbersome. It is seldom that steel headframes are considered for small mines, although I have seen a few, some of them in such remote countries as to cause surprise.

The difference in first costs of timber and steel headframes is not great enough to be the only reason for the general adoption of the former; in fact, at some mines the cost of a steel headframe might be less than one of timber. There are other reasons why the timber structure is more in favor, principal among which are that timber is obtainable in the immediate vicinity of the mine at low cost, or there are more places from which it can be obtained if none is in the vicinity, and such places are nearer the mine than any place from which structural steel could be shipped. Then again, much of the timber structure can be built from stock material bought in quantity for general mine use, few special sizes being required. The question of transportation to mines difficult of access is also of importance, and one that is often considered mistakenly. For structures of equal strength, the weight of material for a steel headframe will compare favorably with that for one of timber. Steel, of course, cannot be floated, which might be of moment in some unusual instances.

### TIMBER HEADFRAMES EASILY DESIGNED

Other points in favor of small timber headframes are that they are more readily designed, or copied. The men in a new mining camp ordinarily will be more familiar with the strength and methods of working, framing and jointing timber than of steel. Workmen and miners can build the structure who would not make a good job in attempting to put together a steel headframe. Furthermore, in most cases, when a headframe is wanted for a mine, it is wanted in as short a time as possible, and a timber headframe can be designed, built and placed in commission while the order for the material for a steel headframe is being filled.

For the small mine the timber headframe fulfils its purpose well; its durability is ordinarily sufficient to make the question of its life one of minor importance. About the only objection is its liability to be destroyed by fire. The danger from fire at mines is now being more keenly recognized than formerly, and engineers are beginning to look to the prevention of fatalities from that source. At a mine where there is but one exit, a fire in the headframe not only may imprison the men in the mine for a long time, but may be attended by loss of life. The fire may spread downward

and set fire to stations, thence spread along the levels to the stope timbers. A steel headframe would eliminate that danger, and for this reason alone should strongly appeal for more general use; indeed, it would, for safety's sake, be advisable to enact a law compelling the erection of a steel headframe at all mines having but one shaft as an exit.

### Standard Steel Headframes

The designing of steel headframes may well be an obstacle to their general adoption, but this does not seem to me to be a grave consideration. Steel derricks for well-boring drills are widely used, and standard structures may now be obtained at short notice from the manufacturers. The task of designing standard steel headframes is a more complex problem than that of drill derricks. This is due to the fact that there is such variance in the dimensions of shafts. For small mines, I fail to see if standard headframes could be obtained, why shafts could not be sunk to standard dimensions. Usually a miner determines the size of his shaft by considering how many hoisting compartments he will need to raise the tonnage of ore he intends to mine. The size of the hoisting compartment depends upon the size of the car, and cars for use at small mines, which alone I am considering, are all about the same size—at least the small miner almost always buys a standard cage, several sizes of which are mentioned in the catalogs of mine-machinery manufacturers.

If, then, the size of the cage is limited to certain standard dimensions, the question of dimensions of hoisting compartments is determined. It only then remains to determine the size of the compartment for water column and air mains. These, of course, need not vary greatly, and if it were possible to buy a standard steel frame for a shaft, say, of two hoisting compartments and one pipeway, or one hoisting compartment and one pipeway, the owner of a small mine would not experience any difficulty in making the dimensions of his shaft conform with those of a standard headframe—in fact, I believe if such headframes were on the market, it would do much toward standardizing shaft dimensions.

### The Case of Inclined Shafts

The problem of designing standard structural-steel headframes is comparatively simple for vertical shafts; a difficulty at once arises, however, when considering the case of inclines. Here the angle of the shaft may vary greatly, and it would be impracticable to design as many headframes as there could possibly be differences of inclination of shafts. Yet, the general principles governing the structure of headframes would remain the same through fairly wide limits, and it would not be impracticable to vary the skip or car-supporting part of the headframe from standard patterns, so that the headframe would be easily adapted to any given dip of the shaft.

Another complexity that would enter into consideration in offering fixed standards for headframes would be that of headframes equipped with ore bins. At some shafts ore bins are not required in the headframe, while at others, not only are ore bins necessary, but a crusher as well. These considerations would call for a greater variety of types of design.

Of course, the foregoing remarks do not apply to the larger mines which are capable of maintaining a staff of men to design and build whatever structures are necessary to meet the particular requirements; such are special cases each requiring its own solution, but I do believe that there would be a demand for steel headframes for small mines if the expense and difficulty of securing them could be reduced by the manufacturers offering standard designs.

J. A. Herdy.

Goldfield, Nev., Aug. 9, 1911.

## Motor Trucks for Mines

In two recent issues of the Journal, those of July 29 and Aug. 5, mention was made of the utility of automobile ore trucks at mines where ore is hauled by wagon to mill, smeltery or railroad shipping station. There should be a demand for such trucks just as soon as wagons suitable for hauling ore are placed on the market. The automobile truck is a comparatively recent development. It is still hardly beyond the experimental stage but it already gives promise of hauling ore at a smaller cost than such work can be done by teams.

At some mines traction engines have been used for hauling a string of wagons. Where the roads were comparatively level and in good condition, they proved to be satisfactory, but the traction engine is too heavy in proportion to its tractive power to do the work that could be expected from the lighter gasolene-motor truck. The traction engine sinks deeply into soft ground, cannot readily run on steep grades, and is too heavy to safely cross the wooden bridges that are so frequently used to carry a road across a stream. The motor truck is free from most of these defects, but in order to pull a number of wagons in one train some special provision will have to be made to control the trailers on steep grades.

This has been the object in view of a German manufacturing company that has recently built a road train in which the lightness of the gas-motor truck is combined with the advantages of a traction engine for pulling a number of wagons. The train consists of a generator wagon and six trailing motor wagons, each of which is capable of transporting 5 tons at a speed of seven to ten miles per hour. The two gasolene motors drive two electric generators. For each axle of all the wagons there is one driving motor. Steering is effected from the driver's wagon, and the provision of suitable shafting between the trailers causes them to follow the bends or curves in the road taken by the generating wagon.

It is said that these trains can travel readily over rough ground; that the wheels, which are fitted with broad tires, do not sink into sandy soil. The weight is better distributed and is less than that of a traction engine of equal power.

H. M. Beatson.

Chicago, Ill., Aug. 12, 1911.

## The Shamva Gold Mines

In the Journal of April 8, Thomas F. Keety mentioned the fact that the engineers that examined the Shamva mines in Rhodesia decided to report the results of sampling in terms they called "reduced assays." This was done on account of the erratic occurrence of the gold.

The Shamva Mines Company owns 293 claims and holds a lease from the British South African Company of the farm upon which the claims are located. Development work has been extended to the third level and the vein has been traced for 1600 ft. along its strike. The estimate of blocked-out ore is 1,019,113 tons, to which a further reserve of 175,000 tons will soon be added. A series of test crushings have been made to determine a correct estimate of the average gold content of the ore. It is interesting to note that the results of these tests checked the "reduced assays" within 20 per cent. The tests returned more gold than was anticipated.

Some criticism of the policy of the engineers in reporting "reduced assays" was made soon after the reports were completed, but from the above facts it is evident that the engineers had good grounds for their conservatism and the results of the tests justified their reporting the assays in the way they did. It was fully known that such reductions from the actual assays had been made, but some shareholders did not appear to be overpleased by the caution of the engineers.

At the Shamva mines the gold occurs in joints in the vein filling, an occurrence which is so irregular that little reliance can be placed upon the results of sampling. When considering the erratic distribution of the gold, the fact that the mill tests checked the "reduced assay" figures within 20 per cent. is evidence that the engineers were not only justified in reporting such reduced figures, but that they hit upon a close margin of safety.

J. Walter Witherspoon.

London, July 15, 1911.

## Valuation of Michigan Mines

According to Associated Press despatches, the report of J. R. Finlay, made to the State Tax Commission of Michigan, values the copper mines at $69,815,000, the iron mines at $119,485,000 and the coal at $861,745. The report is the result of two months of field work. Comparison with previous assessed valuations indicates that a considerable increase is made in the valuation of the iron mines, amounting to about 400 per cent., whereas little, if any, in the case of the copper mines. The worth of the latter is stated by counties as follows: Keweenaw, $12,200,000; Houghton, $57,315,000; Ontanagon, $300,000. The iron mines by counties are: Gogebic, $41,560,000; Iron, $23,339,000; Dickinson, $11,508,000; Baraga, $335,000; Marquette, $42,743,000. The coal mines by counties are: Bay, $484,709; Saginaw, $350,924; Midland, $12,862; Tuscola, $3500; Shiawasse, $9750.

It is stated that the basis for the appraisal consists of a calculation of the value of the mines, to the present owner, for the production of minerals, based on average cost of production, average price for copper and an estimate of future life. It is interesting to note that stock-market valuations were not considered for the reason, the appraiser says, that the value of the stock in many cases depends on gambling rather than on the intrinsic value of the properties. The valuations, thus obtained, cover the worth of the mining business, but do not include property that can be considered of value for other purposes. The price of 14c. per lb. for copper is used in the calculations, and reasons for the selection of this figure are given at length. Only nine copper companies in the State are reported to have made money during the last five years; their actual earnings for that period are given as $50,937,690 with an average price for copper of 15.3c. per pound. The earnings for this period of the iron mines were $57,551,202, without the aid of abnormal prices which are believed to have greatly affected the copper-mine earnings during the years 1906 and 1907.

In connection with recent estimates of the future yield of the various lodes, made by company officials and others, the figures as given by Mr. Finlay are unusually interesting. In his opinion, the Kearsarge lode will yield 70,000,000 tons of ore before it is exhausted. The value of the mines situated on this lode is given as follows: Mohawk, $3,500,000; Ahmeek, $7,200,000; Allouez, $1,500,000; Wolverine, $3,700,000; Osceola Consolidated, $6,000,000. The Calumet & Hecla mine is believed to have about 27,000,000 tons of ore in sight which will yield, roughly speaking, 26 lb. per ton. Of this, 5,000,000 tons are in the form of shaft pillars. Reports at present available do not indicate whether these figures apply to the conglomerate lode, the amygdaloid, or both. The much questioned conglomerate sands, in Torch lake, are stated to be worth $4,500,000, which added to the mine figures gives a total valuation of $31,400,000. For taxation purposes, the Quincy mine is rated at $3,250,000; Isle Royale, $1,450,000; Superior, $1,000,000; Baltic, $5,000,000; Trimountain, $165,000; Champion, $5,000,000; Lake, $300,000; Atlantic, $350,000. The following mines are considered of no value; Franklin (conglomerate), King Philip, Tamarack, Gratiot, Centennial, Victoria, Mass Consolidated, Michigan. It is estimated that the Marquette, Menominee and Gogebic iron ranges will produce 360,000,000 tons more of ore.

Mr. Finlay's opinion is that the future of the copper mines is much less promising than is popularly supposed to be the case. While the mines have shown unusual persistence in depth, the limit of profitable working is now, in most cases, believed to be in plain sight. As an example the case of the Tamarack mine is cited. This mine operates at great depth on the underlay of the Calumet conglomerate, which is by far the richest lode in the district, and which has enabled the Calumet & Hecla to pay $115,000,000 in dividends. Owing to decrease in copper content, the Tamarack has uniformly lost money since 1906. The depth at which the lode became unprofitable was approximately 8000 ft. along the dip from the outcrop. The conclusion, as stated, is: "If this, the richest of all the deposits has played out, it may be taken as a sure inference that inferior lodes will play out at lesser depths." Mr. Finlay says further:

"It must not be forgotten that the tonnage treated now is three times as great as the mines have averaged in their 50 years of life."

## Transfer of Ray Consolidated Smeltery

Despatches state that a transfer of the uncompleted smeltery of the Ray Consolidated Copper Company, at Hayden, Ariz., to the American Smelting and Refining Company will be made within 10 days and that the latter company will immediately proceed with the completion of the works which will be used as a custom plant.

This announcement is believed to be the result of negotiations conducted between Edgar L. Newhouse, for the American Smelting and Refining Company, and D. C. Jackling, general manager of the Ray Consolidated company, during a recent visit of the former to Salt Lake City. It is said that Mr. Newhouse offered to pay back to the Ray Consolidated company the money that had been expended on foundation work and for all the machinery that had been contracted for, and also to give the Ray a low charge for treatment of concentrates from the latter's mill. It is supposed that the final transfer will be made along these lines. This will obviate the necessity of further immediate financing by the Ray company.

## Alaskan Conservation Measures

WASHINGTON CORRESPONDENCE

The adjournment of Congress has been marked by the unexpected outcropping of a number of Alaskan "conservation" measures. Prominent among these is the La Follette resolution, relating to Government ownership of mines and railroads, which was supported by its author in a long speech just at the end of the session. This resolution, which seems destined to be the basis of a long controversy next session, contains the following: "Inasmuch as under existing law the mineral and other resources of Alaska must remain undeveloped or be turned over to private monopoly through control of transportation facilities, provision should be made whereby the Government should own and operate all railroads, docks, etc., make provision for operating and leasing mines at reasonable royalties, with suitable safeguards for prevention of waste and security of life, and in general provide for proper conservation and development of the natural resources of Alaska to be administered by a board of public works to be appointed by the President and confirmed by the Senate."

Almost simultaneous with this resolution was offered a joint resolution in the House by Mr. Humphrey, of Washington, calling for a survey to ascertain the most practicable route for a railroad from a point on Controller bay, Alaska, to the Matanuska and Bering coalfields; that an estimate of the cost of the same be submitted to Congress at an early date; and that the sum of $500,000 be appropriated to carry out the resolution.

A bill to the same general purport was also offered in the Senate by Mr. Poindexter, of Washington. In this it is provided that: The Secretary of War shall proceed to open and mine coal in the Bering River coalfield; all public lands in the Bering River field containing coal be reserved from sale or private entry; a Government line of ships be operated from Controller bay and points in Washington; a Government railroad be constructed from Controller bay to the Bering River field; $5,000,000 be appropriated for the purpose; in addition to supplying the Government needs coal shall be sold commercially to any persons desiring to buy the same, at a price not in excess of the cost of mining plus 4 per cent. per annum revenue on the sums expended by the Government; the boat line and railroad shall be open to all per-

sons alike, as common carriers of freight and passengers, at charges to be fixed by the Secretary of War, which shall not be in excess of the cost of operating and maintaining the same and sufficient to yield a revenue of 4 per cent. per annum on the amount expended by the Government.

"Progressive" members of Congress have declared war upon what they term the special interests centering about the Alaska coal lands and they threaten to make this question a leading issue during the coming winter session.

## Nathan L. Amster

Nathan L. Amster, for many years closely identified with the operations of the Shannon Copper Company, Arizona Commercial Copper Company, and Boston & Corbin Copper and Silver Mining Company, recently disposed of his stock ownership in these companies to a protective committee. Owing to his firm belief in the properties, Mr. Amster had acquired a large holding in these stocks, amounting to approximately 61,000 shares, about equally distributed among the three companies. He suddenly realized that he had a larger amount of these securities than he was able to carry under the existing conditions of the market. Immediately informing his brokers in Boston of this state of affairs, a committee composed of Charles Hayden, William A. Paine and George Baldwin was appointed to protect Mr. Amster's interests. In order to prevent needless liquidation of this collateral, the committee received Mr. Amster's entire stock holdings and has made a settlement of his indebtedness, which is believed not to have exceeded $700,000.

Mr. Amster will probably continue to hold his office as president of the Arizona Commercial and Boston & Corbin companies, but it is believed that hereafter Charles Hayden and William A. Paine will dominate the affairs of the Shannon company.

## New Maryland Cement Plant

The new plant of the Tidewater Portland Cement Company at Union Bridge, Md., was formally opened on Aug. 15. The plant is advantageously situated as regards the Baltimore and Washington markets and also those of the Atlantic seaboard. The capacity is 1,000,000 bbl. of portland cement and 25,000 tons of hydrated lime annually. In addition to the above products the company will also manufacture a waterproof cement and a white portland cement. The hydrated-lime plant has been in operation for about a year.

The raw materials at Union Bridge consist of an unusually pure limestone, resembling marble in appearance, and a volcanic shale. These two materials are found side by side, within a hundred yards of the mill, and the deposits are large.

Four crushers are used: one No. 8 and two No. 6 for limestone and a No. 6 for shale. The stone is handled by hand conveyers. The coal for both burning and power purposes is discharged from a trestle to a pile, beneath which is a tunnel and in this tunnel a belt conveyer. The clinker storage is large, holding 80,000 bbl. and equipped with self-emptying bins and Bates valve packers. Avery automatic scales are used throughout the plant for mixing and recording.

The power plant is equipped with Rust vertical boilers fed by Roney stokers and with Wisconsin engines direct-connected to General Electric generators. The machinery throughout the mill is electrically driven. The raw, coal and clinker mills are equipped with Fuller-Lehigh mills. The kilns are 8x125 ft. each and were made by the Vulcan Iron Company, as were the driers and coolers. Of the three driers one is for shale and two for limestone and the three are so arranged as to take the waste heat from the kilns, making hand firing unnecessary and thus saving fuel. Each kiln is provided with its own cooler, the latter being placed below the kiln, so that the air for combustion passes through them and thus becomes preheated by the hot clinkers discharged from the kilns.

## The Bichromate Iodide Method for Lead

By Richardson T. Wilder*

The following method for the determination of lead in ores is a modification of Low's scheme, no originality being claimed except in the manipulation. It is being used on control work and gives good results. No great amount of care is necessary, and it takes little more time than the molybdate method.

One-half gram of ore is treated as is usual in the molybdate method up to the point where the washed sulphate is obtained on the filter paper. The paper is removed from the funnel and folded lengthwise in such a manner that it can be introduced into a 200-c.c. graduated flask. A few grams of sodium acetate and 1c.c. of acetic acid are also placed in the flask, and about 50 c.c. of water added. The flask is then placed on the hot plate until the lead sulphate is all in solution. This may be hastened by shaking to break up the filter paper.

An excess of standard bichromate solution is now run in from a burette and after mixing by shaking, the contents are made up to the mark with water. Invert flask 10 times with hand over its mouth to mix thoroughly. Take three No. 589 S. & S. filters and fold as one and place in a dry funnel with a dry beaker beneath. Filter off enough of the solution in the flask to get 100 c.c. in a pipette, which 100 c.c. are placed in an Erlenmeyer flask.

Add a few cubic centimeters of sulphuric acid and enough potassium iodide to react with the excess of chromic acid and titrate with sodium thiosulphate in the usual manner, using starch indicator. The standard bichromate contains 3.558 grams of bichromate per liter. The thiosulphate theoretically contains 8.8177 grams per liter, but 9.150 will be more apt to give the desired strength.

Making the solutions this way, 1 c.c. of bichromate should equal 1 per cent. of lead and 2 c.c. of thiosulphate. So that subtracting the cubic centimeters of thiosulphate used from the cubic centimeter of bichromate used will give the per cent. of lead direct, without any further calculation.

### Remarks on the Method

The chromate solution and the thiosulphate solution are both stable, and once standardized will not require further attention for a month or more. They may be titrated against each other occasionally and restandardized if any variation is found.

The lead-chromate precipitate is fine unless boiled, and therefore three filter papers are used. The solution filters quickly, however. In methods where the solution is boiled the lead chromate is of variable composition, depending on conditions of precipitation, basic chromates being formed. This method avoids any washing of the chromate and thus saves time and avoids errors due to washing.

The equations are:

$$K_2Cr_2O_7 + 6\,KI + 7\,H_2SO_4 = 4\,K_2SO_4 + Cr_2(SO_4)_3 + 3\,I_2 + 7\,H_2O.$$

$$I_2 + 2\,Na_2S_2O_3 = 2\,NaI + Na_2S_4O_6.$$

$$2\,Pb(C_2H_3O_2)_2 + K_2Cr_2O_7 + H_2O = 2\,PbCrO_4 + 2\,KC_2H_3O_2 + 2\,HC_2H_3O_2.$$

As has been pointed out by others, lime sulphate and basic ferric sulphate have more or less influence on the results obtained with the molybdate method. With high-lime ores there is a considerable amount of calcium sulphate which remains with the lead sulphate. It is also almost impossible to eliminate the basic ferric sulphate. As calcium sulphate has a tendency to raise the results and iron to obscure the end point in titration, they must be removed or a method used where they cannot interfere. To accomplish this end I offer the above method.

*Apartado 63, Chihuahua, Mexico.

At the close of 1908 there were 203 mines and 50 reduction works in operation in Peru. The total number of employees in the mining industry was 16,849. The Cerro de Pasco company was employing 3700 men. The statistics for the year 1909-10 are not yet complete.

# Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

**Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining**

## An Automatic Belt Cleaner

By John J. Ridgway*

A certain amount, depending upon its character and moistness, of the material carried upon a conveyer belt, tends to cling to the surface. This clinging material causes deterioration which may vary from 5 to 25 per cent. of the total wear on the belt.

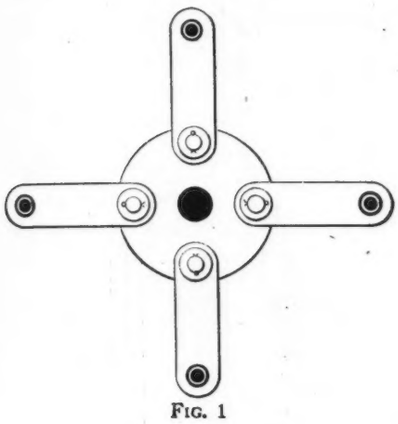

FIG. 1

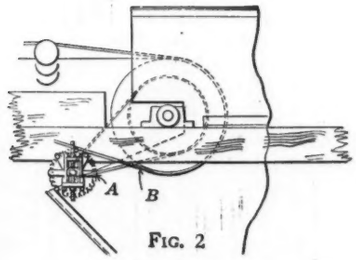


FIG. 2

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DEVICE FOR CLEANING CONVEYER BELTS

Various means have been tried to remove this clinging material, but all on the one principle of brushing; making the brush of fiber, bristle, etc. Not only does this type of brush or cleaner necessitate an almost constant adjustment to compensate for the wear of the brush itself, but its mechanism is complicated and if a counterweight is used and the pressure made constant, then instead of becoming an aid to the longevity of the belt, it becomes a source of destruction.

In the accompanying illustration is shown a type of cleaner that is effective and easily applied. The cleaner *A*, Fig. 2, is mounted on the frame work carrying the end pulley of the conveyer so as to be a little below the bottom of the returning portion *B* of the belt. The cleaner consists of two disks mounted on a shaft, at a distance apart a little greater than the width of the belt. In four holes bored near the outer edge of the two disks, four arms are inserted as shown in Fig. 1, in such a manner that they may swing loosely in the holes in the disk. The shaft is carried in bearings as shown in Fig. 2, and is driven by a pulley, belt connected to a pulley on the end of the shaft of the end conveyer pulley.

By centrifugal force, the loosely mounted arms fly outward and strike the surface of the passing belt above, effectively jarring all clinging material loose. The loosened material falls into a hopper placed just below the device. The blow may be made light or hard by adjusting the bearing screws; the amount of interference of arms and belts is not less than 1/32 in. and may be made as much more as desired. The beater arms, where they come in contact with the belt, being in the form of tubes, become as rollers which revolve in the direction of the belt's travel, thus eliminating objectionable features of wear on the belt which might be excessive were tubes not used.

*207 Fulton street, New York.

## Relief Valves for Blast Pipes

By Percy E. Barbour*

The relief valves shown in the accompanying sketches are used at two copper smelteries in this country. The balanced-valve type, Fig. 1, is being used on a converter blast-pipe with an air pressure of 15 lb. per sq.in. The valve can be adapted to higher pressures by loading the lower piston. This valve works admirably, floating up and down freely with the fluctuations of pressure in the blast pipe.

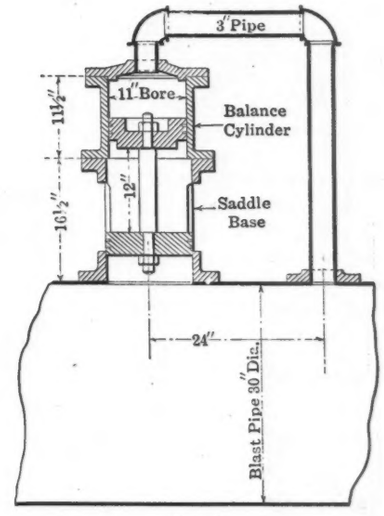


FIG. 1

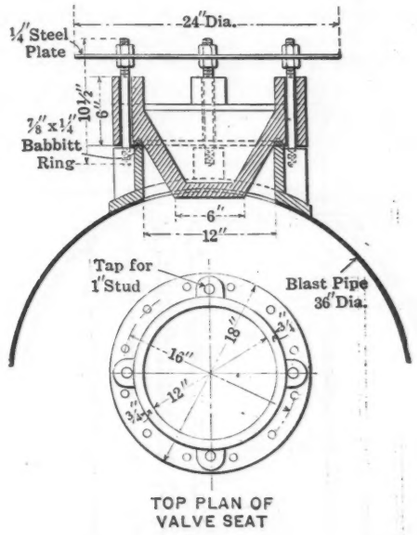


FIG. 2

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TWO TYPES OF BLAST-PIPE RELIEF VALVES

The poppet-valve type, Fig. 2, is being used on a blast-furnace blast pipe with air at 30 oz. per sq.in. This valve can also be used for higher pressures by loading the steel-plate shield at the top.

Both these valves have stood the test of long usage and answer well the purpose of relieving sudden and excessive pressure in the blast pipes while the engine, either by automatic regulator or by hand throttling, is being slowed down.

*Mining engineer, Tecoma, Nev.

## The St. Eugene Headframe at Moyie, B. C.

The St. Eugene mines are near the town of Moyie, B. C., on the Crow's Nest branch of the Canadian Pacific railway, 160 miles from Trail. In 1906 the mines were purchased by the Consolidated Mining and Smelting Company that operates a smeltery at Trail.

The headframe, described by E. P. Cowles in the *Canadian Engineer,* is shown in the accompanying illustration. It is a wooden structure built chiefly of 12x12-in. timbers. The main members of the end brace are made of seven 12x1¾-in. planks.

The center of the 5-ft. sheaves is 81 ft. above the collar of the shaft. Joints are made with ¾-in. iron dowels, and all cross timbers are reinforced with 1-in tie rods. In Fig. 6 are shown the overwinding plates for holding the cage after the rope has been released.

The ore is hoisted in three-ton skips to a point 38 ft. above the collar of the shaft. The skips roll out on a 6-in. roller and the ore falls over a 3½-in. grizzly into the bins. When waste is being hoisted, doors between the shaft and the grizzly are raised, and the waste falls into the waste bin. The waste is dumped into the lake by two self-acting skips, running in a tunnel beneath the shaft house and on a trestle over the railway tracks.

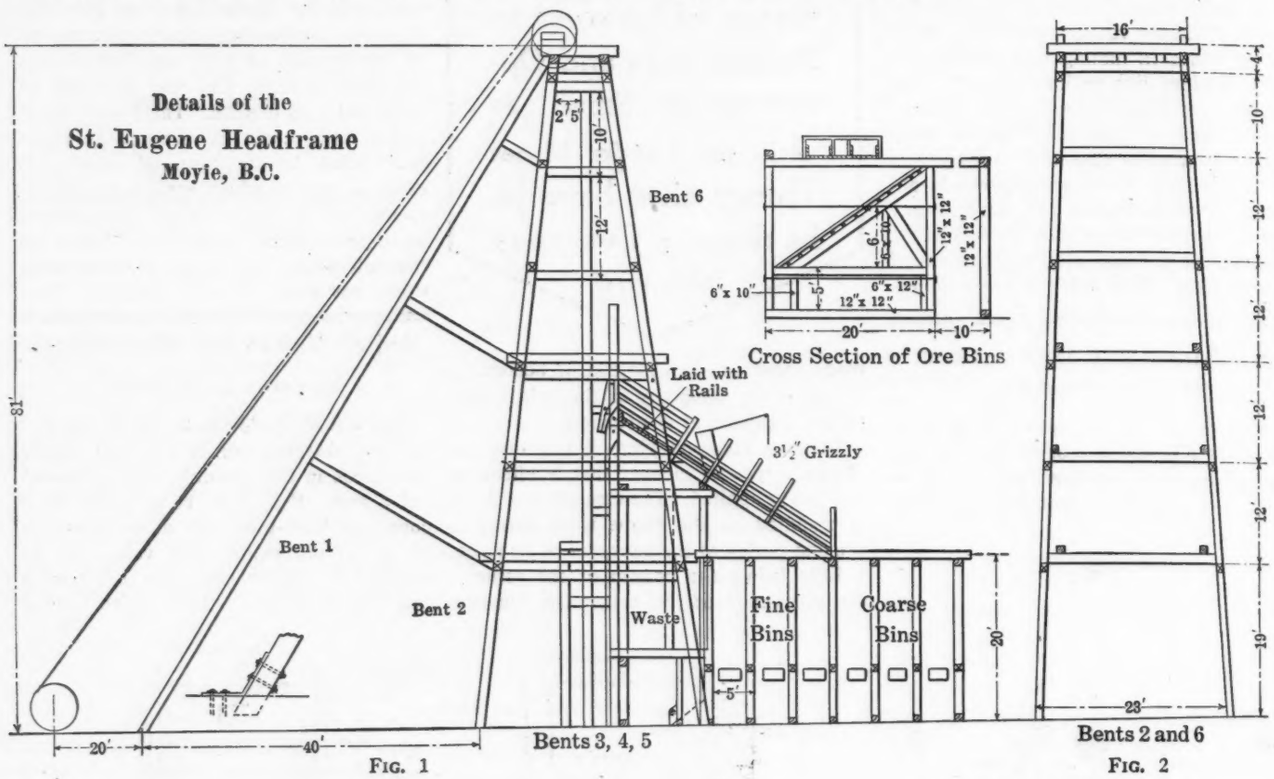



FIG. 1 FIG. 2

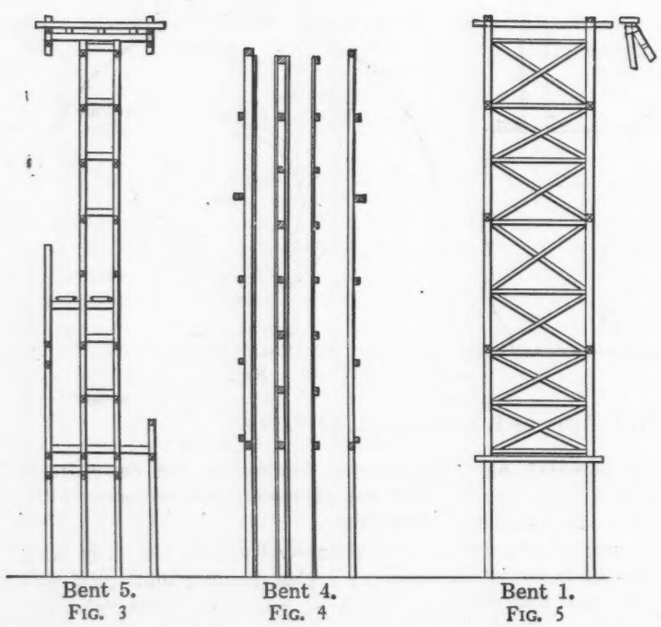



FIG. 3 FIG. 4 FIG. 5

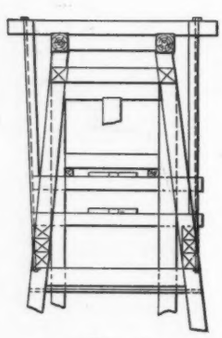


FIG. 6

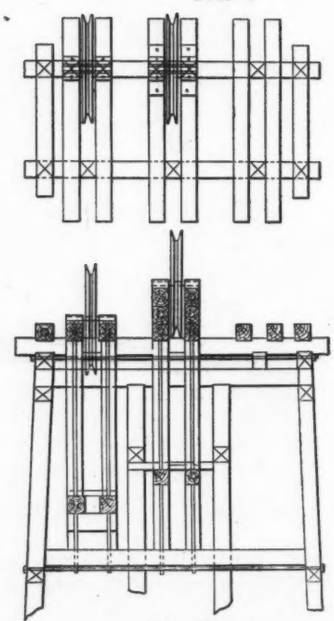


FIG. 7
*The Engineering & Mining Journal*

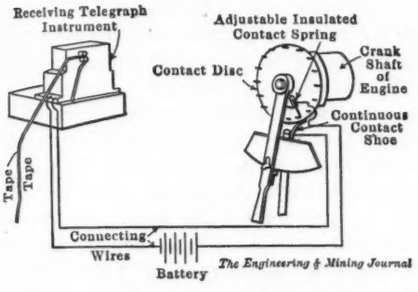
## Cooling Hot Bearings

For cooling hot bearings pulverized sulphur, commonly called flowers of sulphur, is mixed with a heavy oil, preferably cylinder oil, in proportions by measure of one of sulphur to six of oil. The mixture is applied liberally and is suitable for all-sized bearings.

## An Electric Speed Recording Device

The question of the actual speeds and acceleration in the shafts of the Kimberley diamond mines has recently been engaging the attention of the manager, as he was anxious to find out the stresses caused in the hoisting ropes due to the forces of acceleration when the 11-ton skips were introduced. For this purpose an instrument was designed to determine the velocity of the skip at given short intervals throughout the trip.

The electrical speed-recording device, shown diagrammatically in the accompanying illustration and described by Alpheus F. Williams in the *Journal* of the South African Institute of Engineers, consists of two main parts, a contact disk on the crank shaft of the engine and a high-speed receiving telegraph instrument. The contact disk is made of brass and is provided with a number of contact studs near its circumference, equally spaced and at the same distance from the center of the disk. An adjustable insulated copper spring is arranged to make contact with the studs as the




DEVICE FOR RECORDING HOISTING SPEED

disk revolves and a continuous contact shoe is fixed to press against the disk by means of a spring.

The two contacts are electrically connected through a battery circuit to the telegraph instrument, which has the recording tape running at a high uniform speed. The distance between each contact stud on the disk corresponds to a certain known length of rope on the winding drum. Before the engine is started, the insulated copper spring contact is adjusted to come close to the first stud which will make contact when the engine starts, and it is then firmly clamped in this position by means of a thumb screw. As the disk revolves with the winding drum, each contact is recorded on the tape of the telegraph instrument, which runs at a constant speed. The time between the first and the last contact having been carefully observed, the total length of the tape from the first to the last signal is now measured and divided into seconds and fractions of a second.

By means of this scale the time between each signal is found. The distance through which the rope has traveled between any two contacts is a known constant, so that the speed of the rope between each two contacts can be conveniently calculated in feet per second. From these data a speed curve is plotted, the ordinates representing speed in feet per second and the base line distance traveled. The "rate of acceleration" curve can be plotted from the speed curve or direct from the tape. Knowing the rate of acceleration, several other curves can be arrived at by calculation. Continuous indicator diagrams have also been taken of the engine simultaneously with the speed records. With these data and the data obtained with the velocity machine, curves can be plotted showing the total work of the engine, work of raising and accelerating the load, overcoming friction and retardation work.

## Sampling Shipments of Oil

The great increase in the use of oil for fuel has led the Bureau of Mines to publish directions for taking samples, on which the calorific power and other constants are determined.

In sampling wagon deliveries, as soon as the oil begins to flow from the wagon to the receiving tank, a small dipper holding, say, one pint, is filled at regular intervals of time from the stream of oil. About 12 dipperfuls will suffice. These are then poured into a clean drum, well shaken, and approximately one gallon withdrawn for the final sample. If the oil is heavy, the samples may be poured into a pail and stirred with a stick. Whenever a drum is used to collect samples, especially if the oil is likely to stand for a length of time, a tinned drum should be used, in order to avoid absorption of sulphur by unprotected iron.

A continuous sample may be taken by allowing the oil to flow at a constant and uninterrupted rate from a ½-in. plug on the under side of the delivery pipe, during the entire time of discharge.

Water and earthy matter settle out of oil if allowed to stand. Hence, before a large stationary tank is sampled the character of the sludge should be ascertained by dredging with a long-handled dipper, and examining critically the contents of the dipper. If a considerable quantity of sediment is discovered, it should be cause for rejecting the oil. To procure a sample of the oil, an ordinary iron pipe or preferably a tinned tube, 1 in. diameter and long enough to reach from above the manhole to the bottom of the tank, is procured. The lower end of the pipe should be reamed out smooth with a round file. A conical plug of cork or wood is fitted to this end, and a strong, stiff wire, like ordinary telegraph wire, running up through the pipe, should be attached to the plug. A pull on the wire, followed by a rap against the bottom of the tank, will drive the plug home and secure the sample. To take the sample, the plug is allowed to hang 3 in. below the bottom of the pipe, which is then lowered slowly in a vertical position to the bottom. On driving in the plug, the sample can be withdrawn.

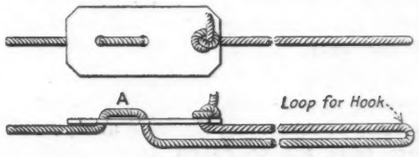
Another way of accomplishing the same result is to lower a one-pint bottle on the end of a stick, a cork attached to a strong string being loosely placed in the neck of the bottle. The bottle is then lowered to any desired point in the tank and the cork pulled out. The sample is then lifted out and placed in a receiving tank. If properly mixed, the several bottlefuls afford an excellent sample of the lot, and from them the one-gallon sample should be taken for analyses.

Sampling a single drum is accomplished in the same manner by the use of a glass tube held vertically and lowered slowly to the bottom of the drum. The thumb or forefinger is then placed over the upper end of the tube, which is then withdrawn and the oil discharged.

Samples should be forwarded in glass bottles or carboys, or preferably in tin cans, which are less liable to breakage. If a tin can is used the cap should be soldered tight. The can should not be filled completely, but about ⅛ in. should be left to allow for possible expansion. The can should be sealed as soon as it is filled, to avoid loss by volatilization of the lighter constituents. Tags should be written with a hard-lead pencil, bearing on with considerable weight, so that the writing may be legible even after the tag is saturated with oil.

## Clip for Plumb Bob Line

The accompanying illustration is of a clip for a plumb-bob string, by the use of which the length of the line may be quickly adjusted. The manner of making the clip is fully shown in the sketch. Brass or copper should be used and the




CLIP FOR PLUMB LINE

three holes made in a straight line and as close together as possible. The whole clip should be as small as it can possibly be made to minimize the tendency for hanging off center.

The blowoff pipe of a boiler became plugged. The difficulty was overcome by attaching a strong hose to the feed-pump discharge pipe and to the end of the blowoff pipe. Then the blowoff valve was opened and the feed pump started for a few seconds with the feed valves closed. When the hose was disconnected the pipe was found to have been freed from its obstruction; thus a shutdown was avoided.

# The Saving of Fine Placer Gold

By Fred H. Hazard*

*The problem of saving fine placer gold has not received sufficient attention. Any process whereby black sands may be collected for independent treatment will promote economy.*

*Mining engineer, 640 South Summer street, Salem, Ore.

During recent years, intricate processes have been worked out for saving the most minute portions of the valuable constituents of ore. In fact, the financial success of a lode mine today is frequently attained only by a high percentage of extraction. The same progress has not marked the treatment of placer gravel. Much ingenuity has been shown in devising cheap and effective methods for the mining end of the operation, but progress in the prevention of loss of fine gold in sands and gravels has not been characterized by striking improvements on methods employed in the early days of California.

### Contrasting Conditions in Placer and Lode Mining

This is not to be wondered at if one considers that success in lode mining depends mainly on a high saving efficiency of mill or metallurgical treatment, while in placer work it depends, to a greater extent, on economies in mining. The former has to deal more with quality, the latter more with quantity. In the former, the arrangement of the mine is planned to accord with the process of ore treatment that is to follow; in the latter, the process must conform to the conditions of the mine. The former, therefore, is not dependent on local conditions and the process of treatment is not affected thereby, while the latter is dependent wholly on local conditions and these conditions are almost never similar: Character of deposits varies widely; grades and dumps must be regulated in accordance with the local topography; water supply is various and variable. Dredge mining, by which many of these adverse conditions are eliminated, has shown the greatest progress in the saving of fine gold.

In 1905 the U. S. Geological Survey, working at Portland, Ore., took up the problem of separating fine gold and platinum from the so called black sands, which have always been the curse of the placer miner. Much benefit was gained by studying the separation of these metals from black sands, but the Survey did not take up the more important investigation—how to save this black sand concentrate cheaply and effectively in placer practice, to be further treated by the methods worked out at Portland.

The object of this article is not to suggest any method of procedure, but to state a few facts brought to my attention in travels through some of the placer fields of California, Oregon and Alaska, and to describe a plant, the design of which more nearly approaches a solution of the problem than anything else that has yet come under my observation.

### A Typical Placer Operation

In most cases, the placer miner faces this condition: He has a deep deposit of earth, sand, gravel and boulders, through which are disseminated practically infinitesimal quantities of gold. To recover this gold the deposit from top to bottom must be treated and, in order to make the undertaking a success, a large amount of material must be handled in the shortest possible time. Water under pressure has made this possible. It has never been found feasible to screen the gravel before it enters the sluice. Therefore, the sluice, besides being the main gold-saving device, must act as a runway for material ranging in size from slimes to heavy boulders. Again, the quantity of water in the sluice is constantly changing, as the nozzles of the giants are pointed to different portions of the bank, and as the caving of the bank sluice.

The sluice, therefore, has to serve too many purposes, under adverse and constantly changing conditions, to expect much improvement in it as a saver of fine gold. It is apparent that only the coarser particles of gold and such of the fine as should happen to come in contact with the quicksilver in the riffles of the sluice will be lodged and thereby saved. As a general rule, it may be stated that the wider the sluice boxes, compatible with the moving of material, and the sharper the grade, within certain limits, the better the results. Both adjustments tend to reduce the eddying motion that keeps fine gold from hugging the bottom and thus coming in contact with the quicksilver. Frequent drops in the string of boxes aid in the breaking up of conglomerated material; likewise the omission of a few sections of sluice in bedrock cuts gives rusty gold a better chance to be brightened, and gold with adhering clay to be freed, by the grinding action between the rock of the cut and the pebbles and boulders passing through it.

### Utility of Undercurrents

Such improvement as has been made in the saving of placer gold has come through the use of the undercurrent, which separates the finer material from the main sluice, to be treated independently. Only within the last decade has the undercurrent been extensively applied and wherever it has been tried, and has received consistent and adequate attention, splendid results have been obtained with nearly all of the various gold-saving devices that have been installed in connection with it.

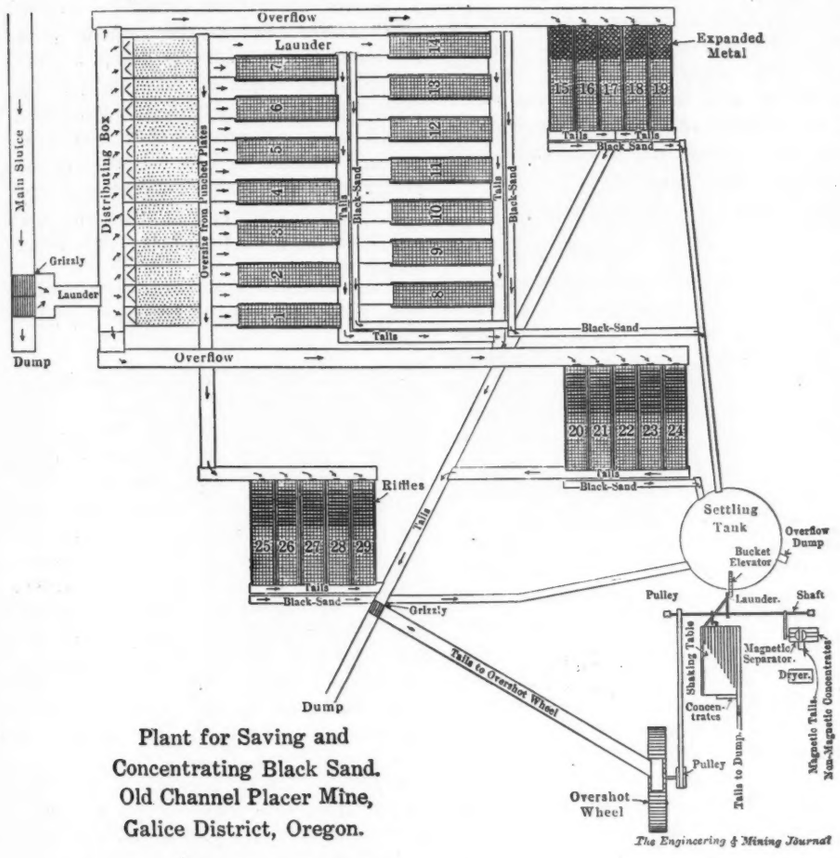
Undercurrents should be placed as near the end of the tail race as possible, for it is advisable to have them pass all of the water not required to force the oversize to the dump. The fines are almost equally distributed from top to bottom of the water as it comes through the tail race, and I believe, as a result of many tests, that the quantity of fines passing over the grizzlies and the quantity passing through bear a direct ratio to the respective quantities of water passing over and passing through. Thus, if one-third of the total quantity of water coming through the sluice fails to find passage through the grizzly bars, one-third of the total fines passes to the dump and is lost. I also believe that this proportion holds good as to the gold values of the fines, as I have panned pieces of rusty gold (some of them worth as much as 10c. apiece) from water dipped not more than 2 in. below the surface of the sluice water, a short distance above the grizzlies.

Two styles of undercurrent grizzlies that have come under my observation possess many advantages over the flat- or round-iron patterns. Both have V-shaped bars. One in use in southern Oregon was cast at a foundry in sections of 1 x 2 ft., four sections occupying the width of the sluice, and extending in length as the season's water supply demanded. If a section became worn or broken it could be replaced without disturbing the remaining sections. The other style, doing splendid work on the lower Klamath river, consisted of V-bars which received a sidewise rocking motion by the passing of water and boulders over them. The hinge effect was obtained by means of inverted U-bolts working loosely in eyes drilled through the thin part of the V-bars; the ends of the bars rested on cross plates to which the bolts were fastened. The V-pattern is a great advantage in the prevention of clogging, and

the latter form was particularly free from this annoyance.

The general principle of gold-saving devices for treating the fines coming through the grizzlies has been to widen the sluice and increase the grade, thereby spreading the water carrying the fines into as thin a sheet as possible and thus giving the fine gold a better opportunity to come in contact with the quicksilver in the riffles.

The experiments conducted at Portland by the U. S. Geological Survey proved conclusively that wherever a loss of black sand occurs there is bound to be a loss of fine gold, and that to make a high saving of fine gold it is necessary to save the black sand. I believe, therefore, that the solution of the problem will be found in a method by which black sand concentrates may be effectively and economically segregated from the fines and treated as a separate product.




**Plant for Saving and Concentrating Black Sand. Old Channel Placer Mine, Galice District, Oregon.**

In 1905, a plant planned with this object in view was established at the Old Channel mine in the Galice district of southern Oregon. The accompanying drawing is a plan of the table plant. The following description is not for the purpose of giving the idea that the plant solved the difficulty of saving fine gold to any notable degree, but merely to depict the ideas carried out in this first attempt to save black sands on a large scale ever made at a placer mine, to show wherein the results failed of the object sought and wherein they approached success.

The Old Channel mine is situated on a bench 1000 ft. or more above the present bed of the Rogue river, and about a mile back from it. The banks of the placer pit are from 100 to 300 ft. high and are composed of the general run of placer material: Soil, fine sand, sand and gravel, and boulders of from a few pounds to several tons in weight. At the time I visited the mine, one 5-in. giant was in constant operation under a 510-ft. head of water, and a 4-in. giant utilized any oversupply of water that might at times be available. Probably from 2000 to 2500 cu. yd. of material were being washed to the 4-ft. sluice per 24 hours. The sluice was placed in a bedrock cut, and was somewhat over 1500 ft. long. The grizzly of the undercurrent was situated a few feet from the end of the last box and was passing about three-fifths of the fines, ranging in size from ½ in. down.

## Plant for Catching Black Sand

The plant for collecting the black sands and fine gold consisted of 29 cocoa-matting tables, as shown. The product passing the grizzlies was carried by a launder to a distributing box, and an amount regulated by 14 adjustable gates was spread, by means of wooden strips nailed to short launders, over iron plates punched with ¼-in. holes. The oversize from these plates dropped to a sluice box and was carried by gravity to tables Nos. 25 to 29. The undersize from the plates was led by appropriate launders to tables Nos. 1 to 14. Such of the material coming to the distributing box as these tables were unable to treat passed over the end boards of the distributing box—a first portion over the end board on the right (as shown in the plan) in an amount regulated by the hight of the end board, and the remainder, if there should be any, over the end board on the left. The material passing over the end board on the right ran by gravity to tables Nos. 15 to 19 and that over the left end board to tables Nos. 20 to 24. The quantity of material coming through the grizzly varied greatly from one moment to another, and this arrangement automatically furnished a uniform supply of material to the main tables, Nos. 1 to 14.

## Construction of the Tables

Tables Nos. 1 to 14 were covered with coarse cocoa matting, the upper end of which was inserted under a strip of sheet iron nailed to the floor at the head of the table; the matting was held on the floor of the table by pressing the sides under 2x4-in. pieces running lengthwise of the tables and held in place by cam levers which, when lowered, bound these pieces and the matting firmly to the bottom. By the use of such levers the matting could readily be removed for cleaning and washing. The slopes of the tables were independently adjustable; a drop of 6 to 8 in. was found to give the best results.

The upper portions of tables Nos. 15 to 20 had expanded metal over the matting, and tables Nos. 20 to 29, inclusive, were each about half covered with Hungarian riffles placed over the matting.

The tailings from all the 29 tables were carried by flume from the ends of the respective tables and sent to the dump. A portion was utilized in furnishing power for concentrating tables and electro-magnetic separators, which were used in the cleaning-up process, by passing over an overshot wheel of 16 ft. diameter.

The concentrates from the tables, which were cleaned in rotation, were led to V-shaped troughs by laying a sheet-iron launder under the bottom edge of the table and over the tailings sluice, and thence were washed to a settling tank. The concentrates collected in the settling tank were fed by a small bucket elevator to a shaking screen, the product passing through a screen being led to a Wilfley table. The concentrates of this table were cut so as to include a large portion

of the black sand. This was then dried and passed through an electro-magnetic separator which removed the valueless magnetite, composing about two-thirds of the bulk. The nonmagnetic portion was again sent to the concentrating table and reduced to as small a quantity as compatible with retaining the gold. The heads were then treated in a cleanup or shipped to a smeltery.

### Shortcomings of the Black-sand Plant

The two chief faults of the plant were the short period during which the tables were efficient, and the length of time required to clean them. Both were responsible for heavy losses of gold and a high expense of operation. The efficiency of cocoa matting as a concentrator and gold catcher ceases the moment the interstices of the matting become filled with black sand; after that the matting acts as a smooth surface and the heavy sand is washed over with the light. Under ideal conditions of grade and uniform flow of material, this period of efficiency was found to be not over 20 min. It required two men working steadily for 5 hours to make the rounds of the 29 tables. A general superintendent was required to adjust the flow of material on the tables and keep the plant in running order. Use was found for at least one extra man per shift. The labor expense for a 24-hour day was as follows:

| | |
|---|---|
| Two superintendents, 12-hour shifts at $3.. | $ 6 |
| Two laborers, 12-hour shifts at $2.50..... | 5 |
| Six table cleaners, 8-hour shifts at $2.50.... | 15 |
| Total (10 men)..... | $26 |

Upkeep and incidental expenses would bring the total expenses to at least $30 per day.

Some of the difficulties experienced were as follows: The punched plates, when placed on a grade such as was found necessary to pass the greater bulk of fines, became banked and required constant attention; a greater length of plates on a sharper grade did not remedy the defect. The bottoms of the tables underneath the matting became banked with fine sands, finally making an uneven surface on the matting above, thus causing sands to clog on the raised portions and the flow to run in narrow streams over the matting. On the tables in connection with which punched plates were not used, the coarser material accumulated quickly and banked the fines. A grade to these tables sufficient to overcome this trouble caused poor results as to retaining black sand and gold. A remedy for the former defect could probably be effected by stretching the matting firmly to the bottoms of the tables, and for the latter trouble by screening out the coarser particles before they reached the tables.

While this plant was far from successful in saving a good proportion of the black sands, or doing it economically, it did prove beyond a doubt that black sands do mechanically carry gold, and that the gold recovered was in proportion to the quantity of black sand saved.

### Extraction of Precious Metals

The manner of saving the gold and platinum from the collected black sand is a matter of minor importance, and resolves itself into a metallurgical or an ore-dressing problem. The process used at the testing plant of the U. S. Geological Survey, at Portland, Ore., was as follows: Screening to as fine a mesh as would pass all the valuable material profitable to save; concentrating on shaking tables of the Wilfley type, either before or after hydraulic classification (a better concentrating product was obtained with some sands by hydraulic classification but with most sands it was found to be of little aid); drying the concentrate and freeing it of magnetite, which generally composes the major part of black sands, by passing through an electro-magnetic separator having poles of low strength, such as the Dings or Knowles; reconcentrating the nonmagnetic product on tables into as small a bulk as practicable. This rich concentrate was then treated by again passing through an electro-magnetic separator of greater strength, such as the Wetherill, which freed it of minerals such as ilmenite, chromite, garnet, and monazite, the remaining portion being treated in a clean-up pan. If the pan failed to make a high percentage of saving, the material was treated by smelting. The latter method is almost imperative where there is a fair proportion of fine platinum. Sodium amalgam was found to amalgamate platinum, but it also amalgamated nails, black sand, and almost everything with which it came in contact. Also its efficiency as a platinum amalgamator was of a short duration, as the water used in washing soon absorbed the sodium from the quicksilver.

### Suggested Design of Black-sand Concentrator

Practice and experiments prove that before treating material for close saving a sizing must be made. I believe that the elimination of oversize by screening on at least a 20-mesh screen is the important feature. In the smaller workings, this might be accomplished by passing the material, as it comes from the grizzly, over perforated plates, and would be wise economy even though it required the services of a laborer to keep them clean. Some mechanical arrangement for bumping these plates underneath could probably be installed in most cases, and operated by some of the power going to waste over the end of the main sluice. In the larger operations, revolving trommels or large shaking screens are essential. By their use the fines would all be saved and the oversize be mechanically disposed of. From this point I believe that hydraulic classification or jigging, or both, should enter largely into the operation. It is yet a matter for experimentation and until some data are obtained it would be unwise for the ordinary placer miner to attempt it.

The screened product should be spread thinly over shallow strips or Hungarian riffles on tables with a slight grade. The riffles should be so installed that they may be easily removed and the tables quickly cleaned at frequent intervals. The tailings from these tables should go to deeper riffles on tables with a sharper grade and quicksilver should be used in conjunction. Before the tailings from the latter tables reach the dump, a profitable saving might be made by passing them through Pierce amalgamators, which have a large capacity and have proved efficient in many instances of placer mining. The advantages in the use of cocoa matting are manifold, and it should be used underneath the riffles on all the tables.

## Phœnix United Mines, Ltd.

### London Correspondence

This company was organized in 1907 to secure the title of the Phœnix United Tin Mines in Cornwall, in which the Cosmopolitan Proprietary and Hannan's Proprietary companies were also interested. Better progress in unwatering is now being made than formerly, because of the fact that the stopes in the deeper workings are not as large as in the upper levels. At the present time the mines have been drained to a depth of 615 ft. below the adit, and this has been accomplished in a manner which appears to be somewhat novel in the Cornwall mining district. A large shaft was sunk at a safe distance from the old workings, and at a depth of 720 ft. a crosscut was extended from this shaft. From the face of the crosscut and with a diamond drill a hole was drilled, through which communication with the old workings was established. This allowed the water to flow to the new shaft and from here it was pumped to surface with an 80-in. Cornish pump, the latter now having been at work for over 16 weeks. It is now believed that a second diamond-drill hole is necessary in order to drain the water to the 720-ft. level.

There is some question as to the economy in this method of "forking" a mine, and it is believed that it is the first time that such a method has been employed in Cornwall. The work at the crushing and milling departments is nearing completion. The prospectus of this company estimated that 150,000 tons of tin ore annually would be milled.

# New Electric Hoist at Ray, Ariz.

*Two-drum hoist raising 21 tons gross load is rope driven from induction motor running continuously at constant speed, drums being operated by friction clutches.*

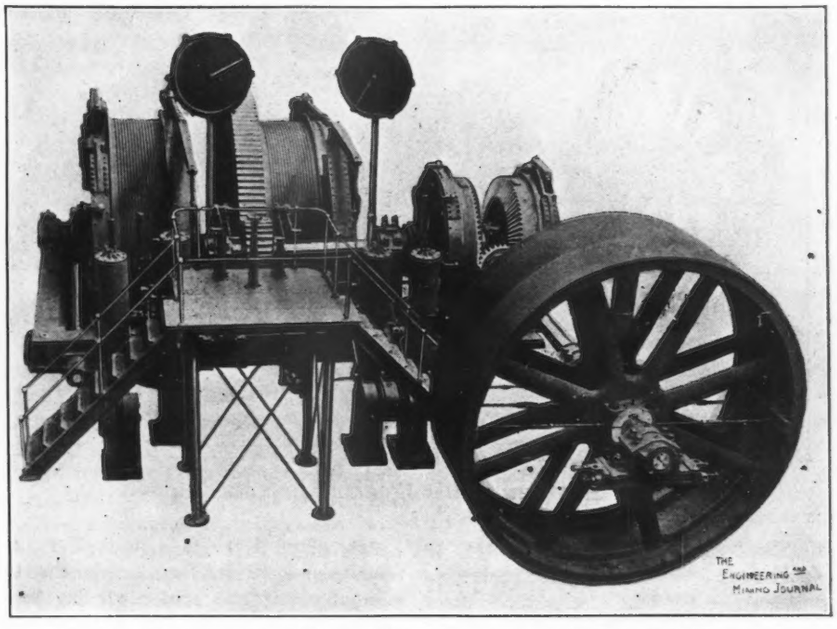
The large electric hoist recently installed by the Ray Consolidated Copper Company at its No. 1 shaft at Ray, near Kelvin, Ariz., has attracted attention on account of some unique features, the heavy loads handled and the large production required from this shaft. The hoist at No. 1 shaft has now been in operation for over three months, and a duplicate hoist is being installed at No. 2 shaft, about one mile distant. The electricity for operating this hoist, as well as the compressors and other machinery about the mines, is generated at the company's power plant at Hayden, Ariz., about 19 miles from the mines, at which point the concentrator is situated, and a smeltery is now being erected. The power is generated by four-cylinder, triple-expansion, condensing engines direct connected to alternating-current generators. The power is transmitted to the mine at a pressure of 40,000 volts.

### Hoist Requirements and Design

The hoist is intended to handle a net ore load of 12½ tons, in a skip weighing 16,000 lb. from a maximum depth of 500 ft., hoisting at a speed of 300 ft. per min. The hoist operates with balanced skips entirely, one of the drums being keyed fast to the shaft while the other drum is driven by a powerful band friction clutch for adjustment to different levels, as desired. The hoist is equipped with an alternating motor, working on 440-volt, three-phase, 60-cycle current, with a full-load speed of 430 r.p.m., and is rated at 300 h.p. continuous rating. This motor is fitted with a rope sheave, 44-in. diameter, having turned grooves for 32 one-inch ropes, the motor being connected to the hoist by a rope drive engaging the 13-ft. rope sheave on the pinion shaft of the hoist.

The idea underlying the design of this hoist is that the motor shall operate continuously in one direction while the drums may be started, stopped or reversed. The principal electric loss in hoists operated by alternating-current motors is occasioned by the starting of the motor, which, when it is a large one, becomes serious. It is, therefore, desirable not to be obliged to start the motor at each trip, since, when the motor is running idly, the current required by it is small, and the peak losses are materially reduced. In this type of hoist, the load is gradually accelerated by applying the powerful clutches, shown in Fig. 3, the design of this clutch being, in effect, a band brake set in motion, which engages as gradually and easily as may be desired.

The accompanying illustrations show various views of the hoist and its details. Fig. 1 gives a general view of the hoist with the exception of the motor, and Fig. 2 shows a side elevation. The power is transmitted from the rope drive to the hoisting drums by means of a bevel-gear, driving and reversing system, clearly shown in Fig. 1. The pinion, which is of forged steel with machine-cut teeth, engages in two cast-steel, machined, bevel gears, running in opposite directions, which are completely inclosed in a steel casing, the top half of which is removed in the accompanying illustrations.




Ray Consolidated Hoist—Rope-driven from Electric Motor

### Arrangement of Clutches

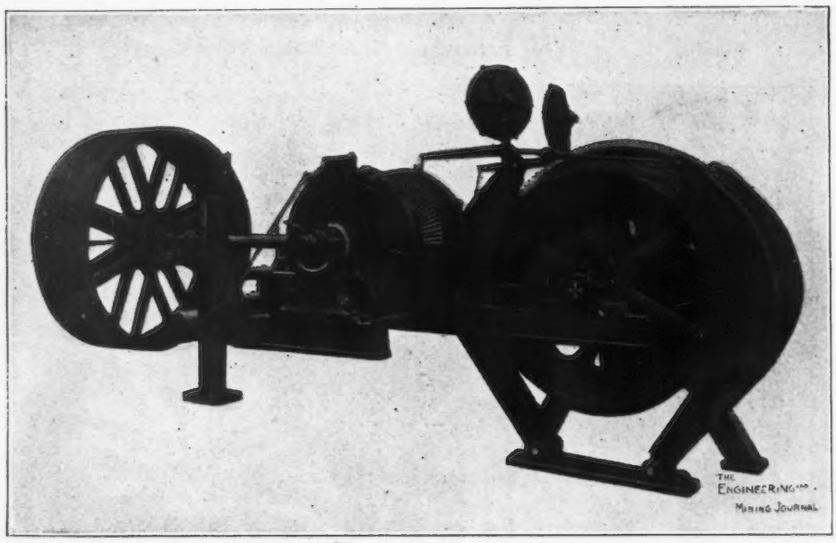
Both gears are loose on the intermediate shaft, being fitted with bronze bushings of ample proportions, easily removable for renewal, while on the back of each of these gears is a friction ring engaged by the band friction clutch. These clutches, shown in Fig. 3, are securely keyed to the intermediate shaft and are operated by the vertical cylinders, shown in Fig. 1, the clutches being applied by weights and released by these cylinders. The cylinders are controlled in their movement by a cataract cylinder filled with oil, the power used in the operating cylinder being compressed air taken from the air mains supplying the mine; an auxiliary motor-driven air compressor is placed in the engine house, which automatically cuts in and provides air for operating the friction clutches of the hoist should the mine pressure be shut off, or fall below a certain predetermined pressure. Both of the clutch operating cylinders are worked by a single lever at the engineer's platform; it is so connected that either clutch may be thrown in at will, but both clutches can never be in at the same time, and one clutch must be wholly thrown out before the other can be thrown in.

### Rope Drums and Brakes

The intermediate shaft is extended and fitted with a forged-steel, machine-cut pinion, which engages, as shown in Fig. 1, the main driving gear for the two drums. This gear is of cast steel, with machine-cut teeth, and is approximately 16 ft. diameter. The drums are 12 ft. diameter, and grooved to carry about 600 ft. of 1¾-in. hoisting rope. The loose drum is fitted with a powerful band friction clutch of the modified Lane type, illustrated in Fig. 4. The clutch is of massive proportions, with a 12-ft. driving ring, and built for a possible working load of 50,000 lb. The clutch disk is of cast steel, and the fixed and movable arms engaging the driving band are of annealed-steel castings. Ample adjustment is provided for taking up the wear of the band, which is of high-grade steel, lined with basswood blocks. Lifters are provided, as shown, for equalizing the distance of the bands from the clutch ring when the clutch is released. Each drum is provided with a powerful post

brake, the beams of which are built up of steel plates and angles, as shown in Fig. 2, and fitted with basswood wearing blocks 14 in. wide.

The brakes, as well as the main clutch, are each operated by means of a combined air and cataract cylinder, fitted with floating valve gear under control of a hand lever on the operator's platform. The design of the connections is such that the brakes are set by means of weights and released by the air cylinders. Dial indicators are provided, one being driven from each drum for showing the position of the skip in the shaft. The skips are not provided with safety appliances, on account of the extreme weight and bulkiness of such equipment for a load of this magnitude, but an overwinding device is provided to prevent the skips from being carried into the sheaves through any neglect of the operator.




SIDE VIEW OF RAY CONSOLIDATED'S NEW HOIST

### OVERWINDING DEVICE

This device consists of two limit switches, one for each skip, so placed that when the skip is carried beyond the highest point for dumping, it will come in contact with an extended lever fitted with a roller, which lever, moving through an arc of 35 deg., disengages the contacts. These limit switches are connected by wires to solenoids operating quick-opening valves in the supply pipes to the air cylinders, so that the solenoids come to action and at once release the air pressure from the operating cylinders, allowing the weights both to apply the powerful brakes and throw out the clutches, bringing the hoist at once to a stop without the necessity of stopping the motor.

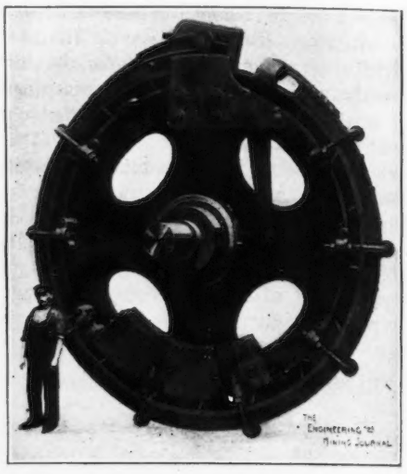
The hoist is of massive proportions throughout, designed with a high factor of safety, so as to guard against any possibility of delay from breakage or derangement while handling this immense tonnage. The ore is handled underground in five-ton steel cars, running in trains propelled by electric locomotives; it is dumped into a 300-ton bin on each of the two main working levels by being run into a revolving tipple, holding three cars at a time, which is completely revolved by an electric motor, discharging the contents of the cars into the bin beneath. The ore is then drawn from this bin to a measuring hopper holding exactly a skip load, the contents of which is immediately discharged into the empty skip as soon as it reaches the bottom. The compartments of the main hoisting shaft are 6x7 ft. in the clear, having a distance of 7 ft. 10 in. center to center of compartments.

### DESIGN OF THE SKIPS

The ore skips are constructed of ½-in. steel plate, 4 ft. 10 in. wide, 5 ft. 2 in. high, and 10 ft. long, while the total length from the center of the bottom swing bearing to the top of the universal socket is 18 ft. The bottom swing bearings and saddles are of cast steel, each having a bearing area on the bottom of the skip of 15⅛x45 in. The swing and saddle shafts are each 5½ in. diameter, collared and located on 22-in. centers. The dumping rollers are of cast steel, bronze bushed with cast-steel trunnions 5½ in. diameter. The crosshead frames are 1¼ in. thick and 20 in. deep, and are provided with special cone roller bearings taking the lower member of the cable socket. This construction permits the cable to twist freely. The forged-steel skip frames are 1¼x12 in. in cross-section. The inside front and back of the skip body are protected by 2½x1-in. bars extending from the mouth of the skip to a distance of 3½ ft. from the bottom. These bars are riveted to auxiliary plates ¼ in. thick, which are bolted to the main body by special ⅞-in. bolts. This permits easy access in removing the bars for repairs or renewal.

### AUXILIARY HOIST FOR WASTE AND MEN

No supplies, waste rock, or men are handled in the hoisting shafts Nos. 1 and 2, but a smaller electric hoist is used in an auxiliary inclined shaft at each plant for handling waste rock and supplies, while the men walk to and from the workings by an easy stairway in these inclined shafts.




BAND CLUTCH FOR LOOSE DRUM

BAND DRIVING CLUTCH

The hoist, together with sheaves, car tipples, etc., were furnished by the Wellman-Seaver-Morgan Company, of Cleveland, O.

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Electric cables in use underground may be protected as follows: Wind first a sisal rope, ¼-in. diameter, spirally around the cable with a pitch of about ½ in., then apply by means of a pad and brush a mixture of one part cement and two parts sand. This coating affords protection against mechanical injury, and serves to indicate any short-circuit in the cable by the bursting of the cement.

# Oxidized Zinc Ores at Leadville

By George O. Argall*

*No ore under 30 per cent. zinc is being shipped, but there is much ore of lower grade. Most extensive deposits found under Carbonate and Fryer hills.*

*General manager, Iron Silver Mining Company, Leadville, Colo.

Although the mining of zinc-sulphide ores has been an important industry of the Leadville district since 1898, it was not until the last year that the large deposits of carbonate and silicate of zinc were recognized as orebodies of great commercial value.

### First Produced at Hayden Shaft

In June, 1910, oxidized zinc ores of a marketable grade were first produced from the Hayden shaft on Fryer hill, and these shipments at once attracted attention. Not long afterward, in the Wolftone mine, an extensive deposit of similar ore was found standing in place and actually blocked out by drifts and mine workings that were driven primarily to facilitate the extraction of other ores. Stimulated by this showing, an active search for oxidized zinc ores was then begun in various other mines, mainly in the previously abandoned and supposedly "worked-out" carbonate stopes, and it was soon demonstrated that these ores occur widely distributed throughout the oxidized zones of the Leadville ore measures.

The early reports attending these discoveries, and the first estimates as to the immense tonnage available for extraction were, of course, somewhat enthusiastic; but the fact still remains that these ores have been found in considerable quantities, and the recognition of their existence is, perhaps, one of the most important events connected with the interesting history of mining in Leadville. The discovery has added largely to the resources of the district and the profitable extraction of these ores has been the means of maintaining the great annual output. At the present time the average monthly output of carbonate and silicate of zinc is 6000 tons, and there is every indication that this production can be maintained for many years to come. Shipments of this material are sent to the zinc smelteries at points in Kansas and Oklahoma and are limited to ores carrying a minimum of 30 per cent. zinc.

### Low-grade Ore

In addition to ores of commercial value, extensive deposits of low-grade ores have been developed; that is, material averaging 22 per cent. zinc which, at the present time, is not a shipping product, as with the existing methods of treatment it cannot be profitably smelted. However, it is probable that the time will come when a process for treating these ores will be successfully developed, and could they even be concentrated sufficiently to raise the zinc content about 10 per cent., it would mean a material increase in the output of shipping ores.

During the early days of lead smelting in Leadville, zinc was occasionally detected in the carbonate ores under treatment, particularly in shipments originating from the Carbonate Hill mines, but there is no evidence that the now known oxidized zinc ores were recognized as such during the period when the carbonate zone was being so actively exploited. Yet this is not surprising, as the operators were searching merely for silver-bearing lead ores, and as no market existed for zinc ores there was no incentive to develop them.

### Zinky Ores Avoided in Early Days

Moreover, the presence of zinc in ore shipments proved a burden, because a penalty was imposed by the smelters on the zinc content; hence it was something to be avoided. Accordingly, if the early operators did appreciate the character and extent of such zinc ores as were encountered, they paid no attention to them because of their uselessness. Those who had given these ores any consideration or had speculated as to what had become of the zinc, no doubt accepted the view that such zinc as might have existed in the primary ores had, by reason of the much greater solubility of its sulphate, been leached out and either carried to a greater distance from its place of original deposition than its associated ores were or else had been entirely removed through the agency of circulating meteoric waters. In depth the oxidized ores changed to sulphides, and for many years the sulphide ores have formed the bulk of the Leadville production; but with the gradual depletion of the sulphides and the increasing expense of deep operations, exploitation turned again to the upper levels in search of ore that might not have been profitable when first opened and thus, at this late date, were realized the character and value of the oxidized zinc deposits.

Recent developments in the oxidized-ore horizons have clearly shown that the zinc, for the most part, has not been removed by surface waters to any great extent, but that it has been redeposited as a carbonate or silicate of zinc or else has been carried down and has enriched the zinc-sulphide ores at greater depth.

### Associated with Original Ores

To a slight extent the oxidized zinc ores are found associated with, or in the immediate vicinity of, the lead-carbonate ores, sometimes forming a more or less complete envelope around the latter. However, by far the greater portion of the zinc has been removed to points more or less remote from the original orebody and redeposited, by a process of replacement, in depressions in the limestone or along some lower contact plane. Under Carbonate hill an extensive deposit of oxidized zinc ore has been found resting upon the parting quartzite and capped by a sheet of gray porphyr that splits the blue limestone formation. Other deposits of similar ore are contained in the white limestone directly underneath the parting quartzite. Invariably all these deposits are connected with the original orebody by stringers of ore following cracks and joints in the limestone or, more frequently, by open watercourses. The inner surfaces of these watercourses are coated with crystals of zinc silicate, showing that the solutions, which carried the zinc, circulated quite freely through the limestone. The relation of the mineralized areas to cracks or fractures is evident, for wherever these penetrated the formations the active zinc-bearing solutions followed down and finally deposited the zinc in irregular-shaped masses of carbonate ore in the limestone at a lower horizon.

### Ores Are Smithsonite and Calamine

The ore consists of smithsonite and calamine, colored reddish to dark brown by the presence of iron oxide. Smithsonite, or the carbonate of zinc, is the predominant ore mineral and occurs mainly in hard, dense, irregular masses replacing the limestone and occasionally in cavernous masses, whose cavities are invariably lined with fine, silky, radiating, needlelike crystals of silicate of zinc. Calamine, or the silicate of zinc, is present in earthy, brown masses and filling cracks and lining cavities in the smithsonite. A zone of ochrous clay is usually found between the orebodies and the limestone, but frequently the line of demarcation between the two is not so marked, and the ore passes gradually and imperceptibly into barren limestone. Fragments of unmineralized limestone and gray, sandy dolomite masses are found inclosed in the orebody. In the vicinity of the original orebody and in the zone of complete oxidation, deposits of zinkiferous limonite are prevalent. It is often difficult to distinguish between the

ore and the altered, discolored limestone; but the former can usually be recognized by the vitreous luster or varnished appearance of its surface and by its greater weight. Little dependence can, however, be placed upon the appearance of the ore and the safest way to determine its contents is by frequent and systematic sampling. The average zinc ore is comparatively free from lead, though it does contain, in varying amounts, such objectionable impurities as iron, manganese and lime, all of which serve to detract from its value as a desirable smelting ore. While it is impossible to eliminate the iron and manganese, the lime can be kept out of the ore by careful mining, supplemented by hand sorting. The silver content in these ores is low, rarely above five ounces.

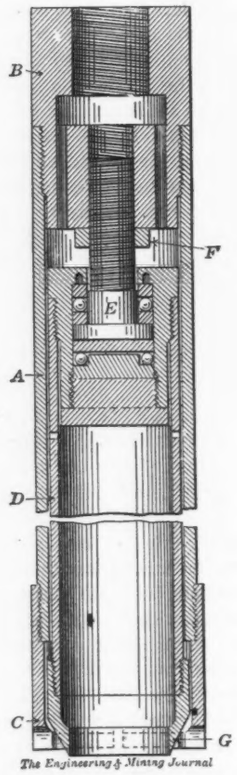
### Order of Deposition

These ores, as previously stated, are found almost entirely in the oxidized zone at points more or less remote from the other oxidized ores of the district with which they were at one time intimately associated. It is evident that the ores, as originally deposited, were a mixture of pyrite, galena and zinc blende. That is, the primary ores were sulphides. The carbonate ores resulted directly as an alteration product of the sulphides, brought about by the oxidizing influence of circulating meteoric waters after the faulting. In all probability the sulphides were oxidized in the following order: (1), Blende; (2), pyrite; (3), galena; and, while the order of succession in this process may have frequently changed by reason of the varying surfaces of the mixed ores exposed to the oxidizing agent, it is still evident that the galena was the last mineral to pass entirely into solution. The decomposition of the sulphides and their subsequent deposition as oxidized ores might be considered to have progressed somewhat as follows: (A), Decomposition of zinc blende and pyrite; (B), the removal of the greater part of the iron in solution and the redeposition of the zinc as zinc carbonate replacing the limestone; (C), the slow oxidation of the galena, and, perhaps at the same time, a leaching of the zinc carbonate by meteoric waters, resulting in the erratic zinc-carbonate deposits and the enriched zinc-sulphide ores at greater depth. This process of secondary alteration and the diverse migrations of the solutions resulting from the decomposition of the blende would account for the present location of the smithsonite as replacement deposits in the limestone, occurring as previously described.

Up to the present, the most extensive deposits of marketable oxidized zinc ores have been found under Carbonate and Fryer hills. Exploration on the other hills has not, as yet, developed any considerable deposits of these ores, but the work accomplished on Iron and Rock hills has shown the zinc to be greatly disseminated through the limestone with small scattered bunches and pockets of pay ore. It is to be expected that similar zinc ores will eventually be found concentrated in large workable deposits in other sections of the district. However, the developments of the last year have demonstrated that Leadville will henceforward be an important producer of zinc-carbonate ores.

## Improved Type of Diamond Drill

In order to overcome the usual difficulty of securing perfect cores by diamond drilling through soft strata, H. R. Ameling has patented (U. S. pat. 997,358, July 11, 1911) an improvement applicable to practically any kind of rotary drill, although the claim refers specifically to the diamond drill. Without following in detail the description given in the patent, by referring to the accompanying illustration, it can be seen that the improvements consist in a chisel-edged tubular bit attached to the lower end of a core barrel, which is supported concentrically inside an outer drill casing. The connecting plug *B*, the drill casing *A*, and the diamond bit *C*, are not much different from the ordinary appliances used. The core barrel *D* is supported by a swivel joint consisting of washers and ball bearings, by means of the threaded plug *E;* the lock-nut *F* enables this threaded plug to be held in any desired position with respect to the connecting plug, *B*, so that the chisel edge *G* can be advanced any desired distance beyond the bottom of the diamond drill *C*.




Section of Improved Core Drill

In operation, water is forced down the pipes in the usual way, and is compelled to flow down around the outside of the core barrel *D*, not coming into contact with the core. The core barrel does not revolve, but is forced steadily ahead as the drill descends. In this manner, the core, even though consisting of soft strata, is not injured by friction, nor by water current passing around it. The distance to which the sharp edge of the core barrel should project below the cutting edge of the diamond drill depends upon the nature of the strata.

For drilling in harder rock, the sharp-edged bit of the core barrel is replaced by a blunt drill, studded with diamonds; the two bits are then adjusted so as to present a flush surface at the bottom, and are so registered that the slots for admitting wash water coincide. When used in this manner, the core barrel, of course, is forced to rotate with the outer drill casing, by means of a different connection in place of the swivel joint shown.

## Rhodesian Antimony Ores

A number of stibnite lodes are known in Rhodesia, as, for example, Hope Fountain, near Bulawayo, Umniati and Belingwe. These are mostly auriferous and have been worked for gold to a small extent. Auriferous and silver-bearing stibnite constitutes part of the ore of the Globe & Phœnix mine, where a plant has recently been erected for roasting the ore for the recovery of the precious metals. In the lower Gwelo district the Gothic and Pagamesa mines contain considerable amounts of auriferous and argentiferous stibnite. A small amount of antimony has been produced in the country, but the deposits do not appear to have received the attention they deserve, the reported output being only 13.75 tons, valued at £75. Cervantite is commonly found on the surface of the gold deposits in the Sebakwe and Hartley districts, while jamesonite is frequent in the lower levels of the mines in the same district.

The production of alloyed steel of all kinds in the United States in 1910 is given by the American Iron and Steel Association as follows: Titanium steel, 326,316 tons; nickel, 106,707; nickel-chrome, 52,021; chrome, 23,550; manganese, 19,360; vanadium, 9049; other alloys, 30,816; total, 567,819 tons. This is an increase of 385,839 tons over 1909; the gain being chiefly in titanium and nickel steel.

# Conditions in the Black Hills

By Jesse Simmons*

*Homestake leads the producing list and has ore in sight to keep it running twenty-five years. Other mines are large producers. Tests are being made on zinc ores.*

*Deadwood, S. D.

The Black Hills are best known as a district productive of low-grade gold ores. It is assuredly upon such a class of ore that the biggest dividends have been paid, and it is upon the successful adaptation of mining and treatment methods to the present known bodies that the most of the future success of the district must depend.

### The Homestake

First among the low-grade mines of the world is the Homestake. Upon an ore returning less than $4 per ton—last year it was $3.75 per ton—an annual production of close to $6,000,000 is being maintained and 6 per cent. dividends are paid on an issued capital of nearly $23,000,000. Ever since George Hearst, one of the principal owners, a number of years ago proposed a toast "to low-grade ore and plenty of it" the policy of the Homestake has been to enlarge and better its plant, both for increased mining capacity and higher percentage of recovery.

For a number of years, the superintendent has stated annually that the mine has 25 years' ore in sight. At that, the Homestake is not a deep mine, the deepest shaft being 1750 ft., and this depth shows no vertical limit to the orebody. In the case of this mine, it is quite conservative to estimate the probable ore as sufficient to supply the plant at the present capacity of 4,000 tons a day for a term of fifty years in addition to the quarter-century supply in sight.

The Homestake is growing in value year by year. At the present time, construction is being completed on a hydroelectric plant of 6000 h.p. This will effect a material saving in the cost of power. With the completion of this extraordinary expenditure of a million dollars, the approximate cost of the installation, the company will be in position to increase its dividends.

### Wasp No. 2

The success of the Wasp No. 2 in profitably treating $2.50 ore, is a splendid example of the achievements of Black Hills operators in adapting methods to conditions. Handling 500 tons per day, the mine produces $30,000 per month, $10,000 of which is being disbursed as dividends. At the present time, a slight change in mining methods is being perfected which will cheapen the cost of mining. The skip tracks in the open cut are being dropped below the level of the bottom of the quartzite orebody, and 18-in. mine tracks are being laid at right angles to them. On these tracks one-ton ore cars will be used. In this way a saving will be made in the loading expense, as the superintendent expects the duty per man to be about 17 tons of shoveling per day. It is now about 14 tons.

Adjoining the Wasp No. 2, the Bismarck Consolidated Company is at work on a new mill of 300 tons daily capacity, to handle ore by dry crushing and cyanidation. As the ores are identical in character with the Wasp No. 2 ore, there is every reason to expect this company will become a substantial producer.

### Bald Mountain District

The ores of the Bald Mountain district (which in this discussion is meant to include Ruby Basin and Portland) occur in approximately horizontal beds in the Cambrian formation. The shoots have for the most part a north-south trend. They are in many cases displaced, cut off and faulted by upheavals and shiftings which probably occurred during the Cretaceous era, when large intrusions of porphyry took place. The ores were apparently formed by ascending mineral waters, which, upon being interrupted in their upward course by an impervious stratum of shale, clay, porphyry, or similar material, spread into the surrounding soft rocks and were absorbed. It is stated that the principal ores of this district are altered dolomite which had the qualities necessary to retain the metallic content of the mineral solutions.

Owing to the limited size of the ore shoots, the largest known being half a mile in length, 12 ft. thick, and 300 ft. greatest width, successful mining in this district depends more upon a "nose for ore" than it does upon blocking out and working big stopes.

The changes of conditions in the mines are many and lead to some peculiar results. On the lower quartzite contacts, the limits of the floor and roof are fairly well defined, but in the upper contact, several hundred feet above, there is apparently no regular floor or roof. Many cases are on record where a shot put in what was at the time recognized as either the floor or roof of a shoot has proved that a few feet away was a larger orebody. In the Mark Twain mine, after a shoot several acres in extent had been worked and the stope about to be abandoned, 12 ft. of good ore was found in the floor. The result was that nearly the entire stope floor was taken up, one or two feet of waste thrown away, and an immense tonnage of ore extracted.

On the other hand, a number of years ago, a piece of property in the center of the productive district, both north and south of which were found big shoots on adjoining territory, was most thoroughly prospected, with results absolutely fruitless. The ore, which could be most reasonably expected to pass through the ground, does not exist in this property.

To revert to the geology of the ore deposits, well defined "verticals" varying in thickness from a knife blade to a couple of inches are the paths of the ascending mineral solutions.[1] When an oreshoot pinches to one of these verticals, it is followed laterally along the recognized floor of the ore in that particular district until it widens out to a workable shoot. A year ago, the Mogul company started a shaft from one of its upper contact mines, following one of these verticals. At a depth of 100 ft., an intruded sheet of porphyry had formed a roof for an orebody and stoping is now in progress at a horizon which was not recognized as a probable ore producer.

Until within the last year, the ores of the Bald Mountain district were supposed to be confined to material analyzing about as follows:[2]

ANALYSIS OF BALD MOUNTAIN ORES

| | Oxidized Ore, Per Cent. | Blue Ore, Per Cent. |
|---|---|---|
| $SiO_2$ | 84.45 | 68.748 |
| $Al_2O_3$ | 4.07 | 3.072 |
| $Fe_2O_3$ | 7.28 | ..... |
| Fe | ..... | 13.829 |
| MgO | 0.25 | ..... |
| CaO | 0.85 | ..... |
| $P_2O_5$ | ..... | 0.842 |
| $SO_3$ | 3.71 | ..... |
| $CaSO_4$ | ..... | 0.833 |
| S | ..... | 11.728 |
| $CaFl_2$ | ..... | 0.784 |
| | 100.61 | 99.296 |
| | Oz. per Ton | Oz. per Ton |
| Gold | 0.574 | 0.325 |
| Silver | 2.875 | 10.550 |
| Tellurium | 8.426 | 4.030 |

The content of precious metal, which is but a minute percentage, has been interpreted by some to be a telluride of gold. At any rate, there is no considerable amount of the gold in the native state. Ores assaying $100 per ton show nothing in the gold pan.

Within the last year, the Golden Reward company has developed an immense shoot of which the following is a typical analysis: $SiO_2$, 54.23 per cent.; FeO, 13.16 per cent.; $Al_2O_3$, 9.51 per cent.;

[1] J. D. Irving, *Professional Paper* 26, U. S. Geol. Survey, p. 155.

[2] "Potsdam Gold Ores of the Black Hills, S. D." F. C. Smith, *Trans.* A.I.M.E., vol. 27, p. 415.

CaO, 1.95 per cent.; S, 11.43 per cent.; MgO, 0.10 per cent.; Zn, 0.02 per cent.; Cu, trace; Loss of ignition, about 7 per cent.; Total 97.56 per cent.; as is indicated by this analysis, the ore is of a soft clayey nature, carrying a high percentage of iron pyrite, and aside from being a distinct innovation in the character of the ore of the district, it is far outside of the accepted boundaries of the productive area. It at once invites further prospecting, and greatly enhances the possibilities of the district.

With all of the work which has been done in the district in twenty years—a production of several hundred tons a day has been made continuously during that time—there is not more than one mine worked out. The theories of the limits and possibilities of this district have, of necessity, been revised so often to cover newly arising conditions that he would be indeed rash who would lay down a hard and fast rule to govern either the character of the ore or the probable ore horizons.

Three characters of ore are mined in the district, viz., brown oxidized, blue, and sulphide. The brown ore is cheaply and efficiently cyanided, the blue ore is smelted if high enough in grade to stand the tariffs. The Golden Reward pyritic ores have been determined by experiment to make a fine cyaniding product when given a light roast, which will be cheap, owing to the high sulphur content.

Five cyanide plants are now operating on Bald Mountain ore, viz., Mogul, Golden Reward, Reliance, Trojan, and Lundberg, Dorr & Wilson. These plants are at present treating 1025 tons per day, and when the second unit of the Trojan mill is put in commission, this total will be increased 150 tons per day. The Golden Reward is having plans drawn for a new mill of 500 tons capacity, which will give that company a daily output of nearly 800 tons. In addition to this, the Imperial company, now shipping to Lundberg, Dorr & Wilson, is figuring on starting its own mill.

### New Smeltery

H. C. Osterman is furnishing the money, and Paul Danckwardt the technical knowledge for a smeltery at Galena. This plant will use the pyritic process, securing the pyrite from the Gilt Edge-Maid mine, the latter company having a concentrating plant well under construction on a site adjoining the smeltery. Limestone will be secured from a carboniferous bed on the hill overlooking the smeltery; silicious ores will be obtained from Galena, Bald Mountain and adjacent camps, and the coke will be the only material hauled any distance.

The natural advantages of the situation of the plant, its close proximity to the mines of the northern Black Hills, coupled with the strides made in cheapening the pyritic smelting process will make it possible for the mine owners of the district to realize on ores that are at present untouched owing to their low grade. Considerable quantities of blue ore in the Bald Mountain mines, worth $8 to $12 per ton, will be handled by the new plant, and ores from the Galena district, now being shipped to the smelteries at Denver and Omaha, will find a market right at home.

A large crew of men is employed on both the smeltery and the concentrating plant, and at the present rate of progress they should go into commission early this fall. The Gilt Edge-Maid mine shows a body of porphyry ore almost 100 ft. wide that will concentrate into a good grade of clean iron pyrite. Another big producer in the Galena camp, is the Sitting Bull, the output of which is now being shipped to Denver.

### Zinc Ores

Exhaustive tests have been made by the Deadwood Lead and Zinc Company upon ores from its Spruce Gulch property. This ore is mined from shoots upon the Cambrian quartzite, and carries galena, blende, gold and silver. In the concentrating tests good separations have been made, the products being zinc-iron middling and galena concentrate. Further tests are now being made upon the zinc-iron product and it is believed a satisfactory separation can be made in Huff electrostatic machines. From thorough sampling of the orebody, it appears that the metals are present, and the only difficulty that remains to be solved is the treatment method. From the extent of the orebodies and the metals contained, this should become an important industry in the near future.

### Development Work

Development is under way at a number of properties, one of the most important of which is the North Homestake, at Maitland, where the shaft is being sunk to open orebodies in the Algonkian slates under the quartzite. For a number of years, this property was a large producer of refractory silicious ores. Diamond drilling disclosed the existence of veins in the underlying slates, and the work now under way will block out these bodies for milling. The Minnesota company, also at Maitland, is developing a mill supply, and the plant will be ready to produce at an early date. R. Bunce, who holds important leases at Carbonate, is retimbering the workings preparatory to production of smelting ores. The Columbia mine, at Keystone, now that litigation has been settled, will soon be upon the producing list. At the Jungle mine, in the Custer Peak district, copper ore, mined in the course of development, is being shipped to Omaha. Altogether, development work this season is most satisfactory in extent and results to date.

### Dredging

The successful operation of the Castle Creek dredge, at Mystic, has given an impetus to operators in that and adjacent fields. This dredge is the first to be installed in the Black Hills, but will be followed by others at an early date. Details have practically been arranged for a like installation at Pactola, and drilling is being carried on at a number of other points in a search for pay gravel. The net result will no doubt be the erection of several boats. Castle creek is a particularly attractive field. The bedrock is only 35 ft. deep, boulders are small—a 5-ft. bucket being large enough—the gold is heavy and the recovery of a high percentage of it fairly easy. The bedrock gravel on this stream has been demonstrated to carry gold, but the heavy subsurface flow of water precludes working it by any but modern mechanical methods.

## Queensland 1910 Mineral Production

The value of the mineral production of Queensland is given, in the *Annual Report* of the Under Secretary for Mines for 1910, as £3,710,222, an increase over 1909 of £53,658. Notwithstanding the persistent decline of the gold yield during the latter years of the last decade, the total annual output of minerals has increased during that period. The production of silver has grown from 571,561 oz. in 1901 to 861,202 oz. in 1910; of copper from 3061 to 16,387 tons; of lead from 561 to 2391 tons; of tin from 1661 to 2953 tons; wolfram from 72 to 856 tons; and coal from 539,472 to 871,166 tons.

QUEENSLAND MINERAL PRODUCTION FOR 1910

| Mineral | Quantity |
|---|---|
| Gold, oz. | 441,400 |
| Silver, oz. | 861,202 |
| Tin, tons | 2,953 |
| Lead, tons | 2,391 |
| Copper, tons | 16,387 |
| Wolfram and bismuth, tons | 910 |
| Molybdenite, tons | 105 |
| Manganese, tons | 792 |
| Coal, tons | 871,166 |
| Limestone (flux), tons | 144,359 |
| Iron (flux), tons | 37,138 |

It is significant that nearly 30 per cent. of last year's gold yield was the product of metallurgical works. It is probably in this direction that expansion most clearly may be discerned. An encouraging feature of the year is the announcement of a railway policy which, by cheapening transport and opening new and linking old centers of settlement, will benefit mining in the state.

The excellent price of tin, averaging for the year £156 per ton, naturally was accompanied by increased activity in those parts of the state where tin mining is the predominant industry, and led to several discoveries of considerable importance. The coal production for last year exceeded that of any previous year.

# Witwatersrand Mining Costs—I

By E. M. Weston*

*Lack of uniformity in reef conditions makes cost comparisons difficult. Large tonnage of ore taken from developed portions of mines reduces the general average cost.*

*Mining engineer, P. O. Box 1176, Johannesburg, S. A.

One of the most difficult tasks that mining engineers can undertake is to attempt to compare the mining costs and relative efficiencies of work done on mining fields in different countries working orebodies varying greatly in character, under conditions differing even more widely.

Ross E. Browne, in 1906, in a valuable paper read before the South African Association of Mining Engineers attempted to compare the relative efficiencies of the work done in mining gold ore on the Rand and in California. Although his work may be criticized on the ground that he overlooked several obvious and easily remediable causes of inefficiency in Rand mining, more particularly those in relation to bad systems of distribution and use of compressed air underground, yet on the whole, many of his conclusions have been justified by developments in recent years.

THE BANDS OF WASTE MUST BE BROKEN AND CANNOT ALL BE SORTED OUT

A FAULT AND DIKE NECESSITATING A LARGE STOPING WIDTH FOR A NARROW WIDTH OF PAY REEF

### No Uniformity in Reef Conditions

James R. Finlay, in his already classical work, "The Cost of Mining," deals also with Rand costs; but as he had not visited the Rand, he follows Browne quite largely. The object of this paper is, by the aid of underground photographs and some late details of the cost of mining in 1910, to enable an engineer who has never visited this field to form his own ideas on the subject of the efficiency of the methods and labor employed.

It should be remembered that along this 50-mile stretch of deposits, despite the general opinion to the contrary, there is no real uniformity of conditions of reef continuity, thickness, or angle of dip, in hardness or firmness of country rock, or amount of water to be dealt with. This will be made obvious as I proceed with my subject. In studying the monthly statements of costs per ton milled, nothing is more striking than the variations in these costs in the 50 producing mines. These range from 12 to 30d. per ton of ore milled. This variation is due partly to differences in equipment and tonnages dealt with, but perhaps still more to the differences already enumerated. I would, in endeavoring to gain a comprehensive view of the subject, roughly divide the mines of the Rand into several distinctive groups.

### Outcrop Mines

Group one includes the older outcrop mines and some of the older deep mines, such as the Robinson Gold Mining Company, Simmer & Jack Proprietary, Village Main Reef Gold Mining Company, and Knights Deep Gold Mining Company. These have many wide stopes from which to draw ore. Large tonnages of ore are taken from pillars and from foot walls and hanging walls of the old stopes. This ore is cheaply mined, much of it costing less than one shilling per ton. In these mines the item, development cost, is almost extinguished. The Knights reef last year drew 33 per cent. of the total ore mined from old stopes.

Group two comprises a number of smaller outcrop mines which are rapidly approaching the end of their career. No development work remains to be done and nearly all their ore is drawn from old stopes and developed ground. On the Ferreira mines the ore mined last year cost only 1s. 11d. per ton. The Salisbury, Jubilee, Glencairn and other mines belong to this group which need not be further mentioned.

Group three consists of other outcrop mines which produce ore on a large scale and which, though they draw a certain unknown percentage of cheap rock from developed ground, yet on the whole draw their main ore supplies from newly developed ground and from the solid. Among these may be mentioned the Van Ryn, the New Modderfontein, East Rand Proprietary Mines, Witwatersrand Mine, New Kleinfontein and Randfontein South.

### Deep Mines

Group four includes the deep mines and the second row of deep mines. These may be said to draw most or all of their ore from the generally narrower and harder stopes of the lower levels. This group includes Crown Mines (an amalgamation including some older outcrop properties and older deep mines producing some cheap ore), Rose Deep, Robinson Deep, Witwatersrand Deep, Knight Central, Simmer East, Village Deep and Cinderella Consolidated. It is the cost of mining in mines such as these, working generally on a large scale, which really represents the present cost of mining ore on the Rand, and which gives

some idea of what the future cost will be when the outcrop mines are exhausted.

Group five consists of those mines on the West Rand near Roodeport which depend for their ore supplies mainly on the "South Reef," which is a narrow band of banket averaging only a few inches in thickness. This on a stoping width of about 36 in. calls for a high percentage of sorting and owing to the treacherous and loose character of the hanging wall, requires a large expenditure in timbering. Some ore is drawn from the main reef, which is wider but pitchy and of lower grade, the mines quoted with lower costs mining the greater percentage. To this group belong the New Unified, Roodeport Central Deep, Roodeport Deep and Princess Estate. Their monthly output is, on the whole, comparatively small.

Group six comprises the mines of the far East Rand, such as Geduld, Brakpan Mines, Van Dyk, Rand Collieries, Klipfontein, Modderfontein State mines and others which are mining or developing in the synclinal basin of this area. These properties will have to mine a reef, rarely showing two payable sections, which lies on a shale foot wall with a quartzite hanging wall. It has a dip of from 5 to 15 degrees. The ground carries heavy water and lies at a depth of a few hundred feet in the Klipfontein to 4000 ft. or over in the Brakpan mines. The only producer so far is the Geduld Proprietary mine, working at a depth of about 2000 ft. The gold is irregular in occurrence and the average width of reef is small.

### Cost Obscured by Large Tonnage

From what I have already stated it is scarcely necessary to emphasize the fact that the real cost of mining ore on the Rand is obscured by the large tonnages of ore milled which have by the work of past years already been developed and exposed on two or three sides.

The mines controlled by the various houses publish details of costs quarterly and yearly, but they group them under somewhat different heads, so that the true mining costs are not so plain as might be wished. From table 1, however, the real costs of mining and developing ore today on the Rand may be fairly well arrived at, and the influence of the large mill and large-output policy on costs may be seen. Some idea of the costs of working the deep and poorer areas in the future may be gained, though there are factors in the problems whose true relative value in reducing or increasing costs are hard to compute. In studying the items shown in this table it is necessary to know what is meant by cost of stoping. If the cost per ton milled is intended, it gives little information. (1) It might mean and has too often meant that crushed material consisted of a great bulk of waste rock with some gold-bearing material broken from stopes where the stoping width exceeds the width of pay reef many times over. (2) Where the reefs are large and solid, or where a narrow stope can be carried, as on a steeply dipping reef with good walls, it may mean the cost of breaking pay reef only. (3) Where the stoping width exceeds the width of the pay reef and where sorting is carried out to its fullest extent either above ground on the sorting table, or below ground in the stopes, or in both places, it will mean the crushing of a mixture of coarse banket with unsortable fines consisting of waste rock and fine ore.

The conditions under which the ore occurs vary so greatly that any attempt to compare costs in individual mines without a proper record being available of the underground conditions met with, and an accurate personal knowledge of these conditions on the part of the critic must lead to erroneous and unfair comparisons.

It was due to conditions, brought about by the efforts of certain people without requisite knowledge to dictate to what the costs on any particular mine should be reduced because a certain other mine had reached these costs, that led to artificial reductions in costs and abuses in mining waste rock which provoked the "Marriott controversy." It is only fair to relate that these evils were already recognized by some of the more practical and enterprising heads of the mining industry, among whom were D. Leslie, consulting engineer, Consolidated Goldfields of South Africa, and Mussen Thomas, manager of the Geldenhuis Deep.

Mr. Leslie gradually evolved a scheme of record keeping which would enable both the manager and the outside critic to gain a better idea of the real economy of the work done. By ascertaining the widths of payable reef in the various stopes of the mine and comparing these with stoping widths a knowledge was gained of the cost of mining the payable reef alone, also the cost of mining the mixed reef and waste tonnage which was milled.

### New Cost-keeping Form

The return form introduced by Mr. Leslie in the mines under his control is divided somewhat as follows: Number of the shaft, section of mine, name of reef, number of stope, fathoms (square) broken per month, stoping width for each stope, average for all stopes on that reef, 50-lb. cases of explosives used, total cost of explosives, cost per fathom for explosives, cost per ton milled for explosives, total cost labor and stores to company, total cost per square fathom to company, fathoms broken per case of explosive, fathoms broken per hand or machine shift, tons reef and waste broken per hand or machine shift, width of pay reef in stopes for each stope, average for all stopes on that reef, total tonnage of pay reef broken, per cent. of pay-reef tonnage broken to total rock broken, number of pay-reef tons broken per fathom, cost of breaking pay reef per ton, cost of ore milled per ton after allowing for the usual percentage of sorting above and below ground or on a milling width, tonnage of milling ore per fathom, and total tonnage of milling ore. If necessary other heads could be added to deal with special cases. The form shown deals only with some of the direct costs, including labor, white and black, and explosives and stores employed in breaking and does not include maintenance, supervision, cost of compressed air, timbering and handling ore after it is broken. If we take some rep-

TABLE I. TOTAL COSTS ON THE WITWATERSRAND

| Name | Thousand Tons Crushed per Month | Per Cent. Sorting | Mining | Developing | Milling | General and Head Office | Total Cost per Ton Milled |
|---|---|---|---|---|---|---|---|
| Robinson | 55 | 16.5 | 6s. 2.8d. | 2d. | 4s. 11.8d. | 11.4d. | 12s. 4d. |
| Simmer & Jack | 61 | 10.0 | 6s. 4.3d. | 7.5d. | 3s. 9.2d. | 2s. 0.4d. | 12s. 9d. |
| Village Main Reef | 42 | 17.0 | ..... | ..... | ..... | ..... | 17s. 0.0d. |
| Knights Deep | 58 | 5.5 | ..... | ..... | ..... | ..... | 11s. 0.0d. |
| Van Ryn | 31 | 10.0 | 5s. 10.5d. | 1s. 11d. | 4s. 8d. | 1s. 6.5d. | 14s. 0.0d. |
| New Modderfontein | 45 | 10 | 7s. 8d. | 2s. 3.5d. | 4s. 5.3d. | 1s. 6.6d. | 15s. 11d. |
| East Rand Proprietary | 200 | 9 | 7s. 4d. | 2s. 6d. | 5s. 2d. | 6.5d. | 15s. 6d. |
| Witwatersrand | 35 | 20 | ..... | ..... | ..... | ..... | 13s. |
| New Kleinfontein | 39 | 19 | 8s. 11.2d. | 2s. 3d. | 3s. 11.9d. | 7.3d. | 15s. 9d. |
| Randfontein South | 110 | 8 | ..... | ..... | ..... | ..... | 18s. 6d. |
| Crown Mines | 120 | 7.5 | ..... | ..... | ..... | ..... | 18s. |
| Rose Deep | 53 | 8 | ..... | ..... | ..... | ..... | 17s. 10d. |
| Robinson Deep | 42 | 10 | 10s. 6.5d. | 2s. 5.5d. | 4s. 6.5d. | 1s. 4.7d. | 18s. 11d. |
| Witwatersrand Deep | 42 | 10 | ..... | ..... | ..... | ..... | 16s. |
| Knights Central | 26 | 8.5 | ..... | ..... | ..... | ..... | 17s. |
| Simmer East | 34 | 14.5 | 9s. 2.6d. | 2s. 6d. | 3s. 10.5d. | 1s. 3.9d. | 16s. 11d. |
| Cinderella Con | 16 | 11 | 11s. 6d. | 2s. 6.5d. | 5s. 1.5d. | 2s. 1d. | 21s. 3d. |
| Village Deep | 42 | 13.5 | 11s. | 2s. 4.4d. | 3s. 8.9d. | 1s. 2.9d. | 18s. 4d. |
| Main Reef West | 20 | 13 | ..... | ..... | ..... | ..... | 18s. 4d. |
| New Unified | 10 | 26 | 12s. | 3s. 4.5d. | 4s. 7.8d. | 2s. 7.5d. | 22s. 8d. |
| Roodepoort Central Deep | 8 | 26 | ..... | ..... | ..... | ..... | 20s. 5d. |
| Roodeport Deep | 15 | 22.5 | 15s. | 3s. 3d. | 5s. 1.5d. | 1s. 2d. | 24s. 6d. |
| Princess Estate | 10 | 33.5 | 10s. 9.9d. | 3s. 6d. | 6s. 10.4d. | ..... | 21s. 3d. |
| Geduld | 12 | 19.0 | 10s. | 4s. 4d. | 4s. 5.5d. | 1s. 9.5d. | 20s. 7d. |

resentative examples showing the cost of breaking ore by native labor, drilling single-handed with 4-lb. hammers, holes being from 24 to 48 in. deep; or with large 3¼-inch piston drills; or small 2¼-in., 2½-in., or 2¾-in. piston stoping drills, the value of this method of keeping records is at once apparent.

### Sampler Has Important Duties

The sampling staff of the mine is made responsible for ascertaining reef assays, widths and configuration in the stopes, which data are plotted on sheets of continuous sections. It is also responsible for ascertaining the real stoping width. Stope widths are always measured some distance back from the face of the stope, as subsequent falls from roof and "slabbing" up of the floor always increase the width actually broken. To estimate stope widths demands considerable skill and judgment. The number of square feet broken in every stope is measured monthly by the surveyor. Great attention has lately been paid to the perfecting of methods and instruments to render the carrying out of this work rapid and accurate under conditions of varying dip of reef and irregular outline of stope faces. The surveyor, from his own data and those of the sampler, calculates the tonnage and other figures required.

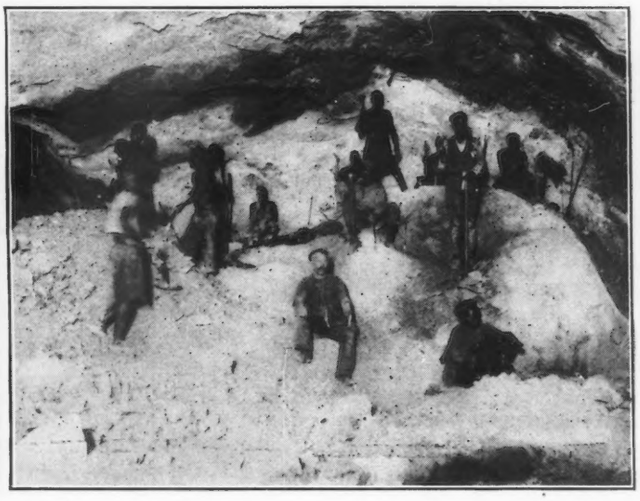
Table II gives a good idea of the cost of breaking ore in a deep mine working narrow reefs, and is compiled from a large number of actual examples. The variations in tonnage broken and in costs are partly due, of course, to the varying conditions of the different stopes but in a far larger degree to differences in the efficiency of the white labor employed in supervision, especially in machine stoping, and to some extent to the variations in efficiency of native labor due to the constant arrival of untrained natives.

### Efficiency Gained by Education

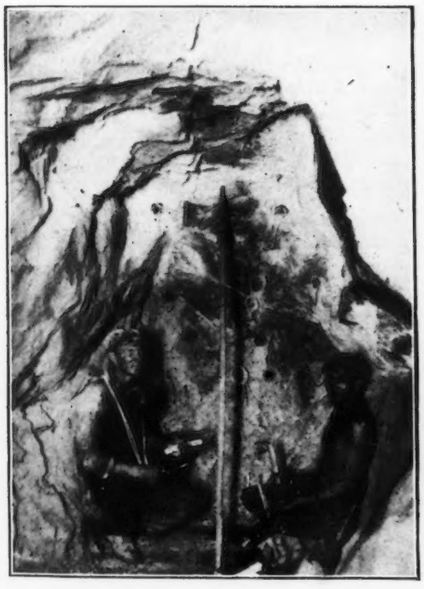
It must be remembered, however, that about 40 per cent. of these new arrivals are returned experienced laborers. The great hope of the future for the reduction in costs is to raise the efficiency of the white miner, especially the drill operator.

One man breaks 12 tons per shift per machine and uses one case, 50 lb., of blasting gelatin to break 3.5

Natives Have to Be Taught the Work and Are, Therefore, Inefficient for Several Months



Hammer Boys, Langlaate. The Reefs Change Their Dip, Making Transport in Stopes Expensive



Developing by Center or Triangle Cut. Method of Loading and Firing at Nourse Mines

Baby Holman Machine in 18-in. Steep Stope with Good Walls at Nourse Mines

Good Hanging Wall and Steep Dip Allow Narrow Stopes. Probably Cheaper to Use Overhand Stoping

fathoms of ground, while his neighbor breaks only seven tons and uses one case of explosive to break 2.5 fathoms. Greater efficiency can only be gained through education.

The South African School of Mines is endeavoring to supply this by providing popular lectures; but the average miner appears to despise help from this source and refuses to believe that a slight knowledge of the theory of blasting and the mechanics of the rock drill can add to his productive capacity. With hand stoping efficiency is encouraged by the employment of the bonus or contract system.

After every shift returns are made out by the shift boss showing for every stope the number of natives working, the number of holes bored and the average depth of these holes, and the quantity of blasting gelatin and stores used. At the end of the month it is therefore easy to calculate the drilling efficiency of the natives, the number of natives required to break one fathom of ground or a ton of rock per shift and the amount of explosive used per ton of ore broken. Men are then paid a bonus for good results.

Returns might show that with unskilled natives, many shifts were required to break a square fathom of ground though the quantity of explosive used per ton broken was small. In this case the miner must have shown judgment in putting in and loading the short holes his natives alone could bore and therefore had worked well. I am convinced that costs would be reduced in both hand and machine stoping by granting longer contracts. A miner known to be capable should be given a contract to stope a certain block of ore that would employ him for from three to six months. He would thus be encouraged to exert himself to the utmost, being sure of a reward for his efforts.

With the system at present in use a contractor's price may be cut down at the end of any month and he has therefore no security of reward for sustained effort and skill. On the other hand, managers and underground managers appear to be reluctant to let long contracts, fearing that trouble would be caused should wage sheets show large earnings; but this is a short-sighted policy.

### Stoping Costs

Table II shows that a ton of milling ore costs to stope from 3s. 6d. to 5s. 6d. per ton in stopes from 40 to 60 in. in hight, plus the cost of compressed air, rock-drill maintenance, steel sharpening and administration underground.

At the Robinson Deep in August, 1910, about 41 per cent. of the total area stoped, equal to about 31 per cent. of the total tonnage stoped, was broken by small drills.

The cost per ton broken was 6s. 0.3d., as compared with 5s. 7.3d. for rock broken by large machines, and 6s. 11.5d. for hammer boys. The cost per fathom was 72s. 4.4d. with small machines, 78s. 1.1d. with large machines, and 82s. 1.1d. with hammer boys. The respective stoping widths were 48 in., 55.7 in. and 47.2 in. These fathomage costs, applied to the tonnage which would be derived from a stoping width of 55.7 in., would give a relative cost per ton broken of 5s. 2.3d. for small machines, as compared with 5s. 7.3d. for large machines, and 5s. 10.8d. for hammer boys.

The main reef and leader at the Ferreira mine[1] run together, giving a total width of reef of about 12 ft. The main reef portion being of poor value, the leader bands only were stoped on to the so-called interbedded dike, which is here slightly decomposed, giving a narrow soapy band and making an excellent foot wall to break to, the hanging wall also is regular and forms a good breaking plane, the average stoping width being about 6 feet.

All stoping was done on contract, double shift, at a price of 40s. per fathom, and an average of the results obtained was as follows: Fathoms per machine per shift, 0.582; tons per machine per shift, 10.48; cost of explosives per fathom, 12s. 1d.; cost of explosives per measured ton, 8.06d.; pounds of explosives used per ton, 0.57; total cost per measured ton broken, 3s. 1d. This includes contractor's earnings, cost of machines, upkeep, drill sharpening, etc., exclusive of timbering.

### Extra Drilling Costs

Mussen Thomas states that the cost of breaking a ton of ore in a 60-in. stope is 4s. 6d. and in a 36-in. stope 7s. 6d. E. J. Way gives the average cost of breaking a ton of ore in the new Kleinfontein mine as 4s. 6d. The following figures are given to show extra costs which must be added to those shown in table II. The cost of compressed air per shift per machine may in some of the older mines be as much as 15s. per shift owing to old and inefficient compressors and air-pipe systems.

Cost of one machine shift in a modern mine: Compressed air and maintenance, 5s. 1.54d.; maintenance of drills and hose, 2s. 8.89d.; cost of steel used, 3.71d.; cost of sharpening drill bits, 2s. 6.62d.; total, 10s. 8.6d. This would mean an added cost of about one shilling per ton to that shown for breaking with large piston drills and as the consumption of air in the smaller drills is proportionally reduced the added cost per ton broken by them would be about the same. The cost of underground administration, i.e., salaries of underground manager, shift bosses, etc., probably would not exceed one penny per ton.

Another authority in 1909 gives the total cost for a machine shift breaking 10.5 tons per machine as follows: White labor, 18.87s.; colored labor, 10.13s.; compressed air, 7.96s.; maintenance of drills, 3.22s.; explosives, 13.62s.; stores, oil, fuse, candles, etc., 2.76s.; drill steel and sharpening, 2.82s.; total, 59.2s. or

TABLE II. COST OF STOPING ON THE WITWATERSRAND

| | Average Width of Pay Reef, Inches | Average Stoping Width, Inches | Average Per Cent. Pay Reef of Total Rock Broken | Pay Rock per Fathom, Tons | Rock Broken per Case of Explosive, Square Fathoms | Rock Broken per Shift, Tons | Average Cost per Ton of Pay Reef | Cost per Ton of Milling Ore | Cost of Explosive per Ton Milled | Cost of Explosive per Square Fathom | Total Cost per Fathom |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hand stoping by natives, supervised by whites | 18 | 48 | 38 | 4.5 | 5.0 | 1.0 | 12s. | 5s. 6d. 40-in. milling width | 9.5d. | 8s. 6d. | 55s. 6d. |
| Machine stoping with 3½-in. piston drills, by natives, supervised by whites | 24 | 61 | 40 | 6.0 | 2.8 | 10.0 | 7s. 3d. | 3s. 6d. 50-in. milling width | 1s. 4d. | 16s. 0d. | 44s. 0d. |
| Machine stoping, with 2¼-in. and 2¾-in. piston drills | 14.5 | 43 | 36 | 4.0 | 3.0 | 5.5 | 18s. | 5s. 5d. 36-in. milling width | 1s. 8d. | 15s. 0d. | 48s. 0d. |

[1] *Journ.* Chem., Met. and Min. Soc. of South Africa, November, 1910.

5s. 6d. per ton. With hand stoping the average cost for steel used, for sharpening steel, and for hammers is about 5d. per native shift, and with underground supervision costs from 6 to 7d. per ton milled which must be added to the 5s. 6d. shown in table.

*(To be continued)*

## Zinc Dust Precipitation

By C. W. Merrill*

One of the noteworthy features in the development of recent cyanide practice is the increasing use of zinc dust as a precipitant for the precious-metal solutions. Originally tried and pronounced a failure, it is interesting to note its recent general adoption throughout the mining countries of the world. Obviously, its abandonment during the earlier years of the industry must have been due to unsatisfactory results obtained through unskilful handling and failure to appreciate the fundamental principles governing the process. It may still be truthfully said of the zinc-dust process that its operation requires a more intelligent supervision than the old zinc-shavings method, but this point is more than offset by the increased efficiency and decreased operating costs obtained.

### Growth of Zinc-dust Precipitation

A large majority of the mills built during the last year in the United States, in Canada and in Mexico, have installed the new process, and almost without exception record material saving over the older method. In South Africa, where the dust process was only introduced within the last year, five installations are now either in actual operation or under construction. These installations were made by the Merrill Metallurgical Company, and as a direct result of a series of experiments conducted by the Mines Trials Committee of South Africa, to determine the relative merits of the Merrill process and the usual zinc-shavings process, and in spite of the unsuccessful efforts previously made by local metallurgists to apply zinc dust.

In keeping with their usual progressive and broad-minded policy toward new ideas, Mexican engineers and metallurgists have been quick to see the advantages of dust precipitation as applied to silver cyanidation, and most of the recent mills in that country are equipped with this process. At one large plant in Pachuca where the new process was installed, the silver bullion recovered by this method will be in the neighborhood of 20 tons per month.

It sometimes is claimed by those unfamiliar with the process that the consumption of zinc is higher and the grade of precipitate lower with zinc dust as a precipitant than when using zinc shavings. Data are available to show that in reality the exact opposite is true.

At the Homestake mine, in South Dakota, the amount of zinc consumed in precipitating exceedingly low-grade waste solutions was 0.17 lb. per ton of solution with shavings, and 0.12 lb. with dust. The grade of precipitation was $2.35 per lb. with shavings and $4.03 with dust. At this mine, which is now cyaniding about 130,000 tons of ore per month, the total consumption of zinc dust does not exceed 0.1 lb. per ton of ore treated.

At the North Star mine, Grass Valley, Cal., where shavings precipitation was replaced by zinc dust, the consumption of zinc was reduced by one-half and a better grade of bullion obtained. At the Pittsburg-Silver Peak mill, Blair, Nev., cyaniding in the neighborhood of 14,000 tons of ore per month and where zinc dust has been used since the beginning of operations in 1908, the consumption of zinc is 0.167 lb. per ton of solution, with practically perfect precipitation. The raw product, when removed from the filter presses, contains 12 per cent. zinc, and after acid treating this is reduced to 3½ per cent.

At the new mill of the La Blanca company, Pachuca, Hidalgo, Mex., the consumption of zinc is 0.93 lb. for each pound of pure silver produced, and the precipitate taken from the presses at cleanup contains 73 to 75 per cent. fine silver. At the Santa Gertrudis mill, also situated in Pachuca, and which began crushing during the latter part of June of this year, most gratifying results are being obtained with the Merrill process. The consumption of zinc is 1.2 lb. per pound of bullion produced. The raw precipitate from the presses carries 87 per cent. of fine metal and the melted bullion assays 950 fine gold and silver. The average consumption of zinc in Mexican silver mills using shavings is close to 1.5 lb. zinc per pound of fine metal recovered with a precipitate 60 to 70 per cent. fine, although a zinc consumption of 1 to 1.2 lb. and a precipitate of 75 to 80 per cent. is obtained in a few instances, when precipitating exceedingly rich solutions.

### Dust Process More Economical

An interesting comparison of the costs of these two methods of precipitation is furnished by the large cyanide plants operating at El Oro, Mex. These mills are of approximately the same tonnage and the ore milled is similar in character. The costs for precipitating and melting at three of these mills are as follows: No. 1, with shavings precipitation, 30c., Mexican currency, per ton of ore treated; No. 2, with shavings precipitation, 20c.; No. 3, with dust, 16 cents.

As an illustration of the superiority of the dust method over shavings in certain individual cases, the installation of the Goldfield Consolidated Mines Company, at Goldfield, Nev., may be cited. At this plant it is necessary to precipitate solutions containing considerable copper, the amount present being sufficient to plate and polarize shavings after a short immersion in the solution. With dust, however, owing to the fresh zinc being continuously added, this polarization is prevented, and although the precipitate contains upward of 40 per cent. copper, the precipitation is uniformly good.

### Other Advantages of Zinc Dust

It is to be borne in mind that one of the chief economies of zinc-dust precipitation, as compared to shavings, is that the first cost of zinc dust is from 20 to 25 per cent. less than that of zinc sheets, depending on the fluctuations of the metal market. In cyaniding silver ores, particularly where the consumption of zinc is frequently as high as 3 lb. per ton of ore treated, the economy of the zinc dust is obvious.

Inasmuch as the reactions involved in precipitating metals from cyanide solutions are essentially those of reduction, it is desirable in carrying out any precipitation process that contact with the atmosphere be avoided as far as possible. In the new zinc-dust process this is accomplished by bringing the precipitant and the solutions into contact with the entire exclusion of air and maintaining this condition until the precipitate has been separated from the solution in a filter press. Re-solution of the precipitated precious metals by oxidation is thus prevented. A minimum consumption of chemicals is obtained by virtue of the fact that in this process the contact between the zinc dust and cyanide solution is kept down to the shortest interval consistent with efficient precipitation.

Another point in favor of the zinc-dust process that should appeal strongly to all cyanide managers, and particularly those operating custom plants, is the ability to cleanup and convert into bullion at any time all of the precipitated metals in the mill. With the shavings process something like 30 per cent. of the cleanup is carried over in the boxes from month to month, and an accurate check on mill recoveries is rendered quite impossible.

The chances of loss of valuable precipitate, due to theft or fire, are materially lessened, the product being collected and stored in a heavy cast-iron filter press, which is opened only at stated intervals for cleanup, and then under trustworthy supervision. At the time of the fire at the Goldfield Consolidated company's mill, the Merrill presses contained upward of $500,000 worth of gold precipitate, but not a dollar of this was lost, even though the presses became so hot that the precipitates upon removal were found to be completely roasted, and the press cocks were spouting zinc flame during the fire.

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# Some Gold Deposits of the Northwest

By Francis Church Lincoln*

*A resume of the features of ore deposition in some mines in Montana and Idaho where ore was formed by replacement or by contact metamorphism.*

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As producers of gold, Montana and Idaho rank sixth and eighth, the former having $3,465,364 and the latter $992,930 to its credit for 1910. The gold production of Montana comes mainly from the copper ores of Butte. These States contain several economic gold deposits of more than ordinary interests. In Idaho, the DeLamar is the most important gold deposit in rhyolite. In Montana, there are three interesting types of gold deposits of contact metamorphic origin; the Cable native gold contact metamorphic deposit, the Spotted Horse fluoritic gold-telluride contact breccia and the Drumlummon contact vein.

### Ore Occurrence at De Lamar

De Lamar[1] is situated in the Owyhee range in southwestern Idaho, about 5 miles west of Silver City. Placer gold was discovered in the neighborhood in 1863 by a prospector named Jordan, and as the ground was rich a large mining population soon sprang into existence. The lodes were discovered soon after the influx of population, but were thought little of for a long time. De Lamar bought a claim for a few thousand dollars in 1889, developed it and acquired adjoining claims, and in 1891 sold out to an English company for $1,700,000. This company produced about $6,000,000 within seven years.

The Owyhee range is the most northerly of the Great Basin mountain groups. De Lamar is just west of the highest peaks in the range at an elevation of 5500 ft. above sea level, and its veins outcrop on a ridge south of the town, at an elevation of 6000 ft. The mountains to the eastward have elevations exceeding 8000 ft. and are extremely rugged, but going toward De Lamar the declivities become less steep and beyond it are gentle hills. The town of De Lamar is in the valley of Jordan creek, a tributary of the Owyhee river, which in turn is tributary to the Snake.

The winters are severe, with heavy falls of snow and strong winds. The summers are warm and dry, with occasional showers. Snow banks frequently last throughout the summer on the eastern slopes of the higher mountains. Grass is abundant and trees scarce. A few cottonwoods grow along the creeks and patches of juniper, pine and mountain mahogany on the higher ridges.

The Owyhee range has a granite core which is probably of Post-carboniferous age. In early Tertiary time, this granite mass formed a steep narrow ridge having the same general trend as the present mountains. Volcanic vents opened near the summit of the granite range in Miocene time and from them were poured forth great quantities of basalt succeeded by equally large amounts of rhyolite. This occurred at the same time that the enormous flows of Columbia basalt took place further to the westward. The basalt temporarily dammed the headwaters of the Snake river and caused the formation of Lake Payette from which the Owyhee range rose as an island. Later than the rhyolite eruption, and possibly in Pliocene time, a comparatively insignificant eruption of basalt occurred. Since the outpouring of the lavas, erosion has continued uninterruptedly to the present day.

In Post-miocene time, the rocks of the Owyhee range were subjected to stresses producing fissures which often closely followed the lines of older dikes. Heated waters rose through these openings and deposited the ores. The silver veins of Silver City are in all three of the country rocks, but the gold-silver veins of De Lamar are confined to the rhyolite. At De Lamar the period of vein formation consisted of two distinct stages; one in which calcite or barite was deposited and another in which the first minerals formed were entirely replaced by auriferous quartz.

### Linked Veins in Rhyolite

The veins of De Lamar fork and join so as to constitute a linked system; there are 10 of them, from 20 to 80 ft. apart. The individual veins are from one to six feet in width. Their average strike is north 35 deg. west and their average dip 38 deg. southwest. The veins are confined to the foot-wall side of a body of decomposed rhyolite known locally as the "iron dike." It is a mass of compact pyritiferous clay dipping south or southeast 30 deg. or less, with frequent rolls and curves. Although the veins sometimes abutt against the "iron dike," it does not appear to fault them, but rather to have been formed at an earlier period and to have absorbed the fissure-forming forces so that they became inoperative above it.

The filled fissures are usually sharply separated from the rhyolite country of which they contain angular fragments. The filling has a peculiar laminated structure. Thin tabular pieces of quartz cross one another in every direction and are encrusted on both sides with minute quartz crystals. This quartz is evidently pseudomorphic after the calcite or barite which constituted the original filling of the veins. The altered country rock adjoining the veins contains pyrite, marcasite and a little sericite. It is usually strongly silicified.

### The De Lamar Ore

The ore is mainly the friable quartz vein filling since the silicified rhyolite contains but a trace of gold. The kaolinized rhyolite, while of low gold tenor, may be rich enough in silver to form ore. The average grade of the ore is $14 in gold and $2 in silver, but some high-grade ore has been mined; in 1891-2, 340 tons averaging $5000 per ton were shipped. About 61 per cent. of the gold is amalgamable. The concentrates while averaging $476 per ton make up only 0.75 per cent. of the ore.

The main producing zone extends from a little below the surface down to the tenth level, following the dip of the "iron dike" and having dimensions of about 600x400x700 ft. Within this zone nearly all of the veins contain oreshoots. The clay of the "iron dike" apparently dammed back the ore-bearing solutions and caused the precipitation of mineral with a higher gold content just below it. The oreshoots are never more than a few hundred feet from the decomposed rhyolite. They pitch from 20 to 30 deg. in a southeasterly direction. The shoots are from one to 30 ft. in width, about 200 ft. in length, and some of them extend all the way from the surface to the tenth level.

Quartz is the principal gangue mineral. With this there occurs a small amount of barite, and in one instance valencianite, the vein variety of orthoclase. The ore minerals are rarely visible; pyrite is the most common. Native gold, argentite and pyrargyrite are found, and more rarely marcasite; cerargyrite is the only secondary mineral noted. The native gold occurs in deep yellow to pale yellow irregular flakes. It is finely divided.

### The Drumlummon Contact Vein

The Drumlummon mine[2] is at Marysville in Lewis and Clarke county, Montana, 17 miles northwest of Helena. It is reached by a branch of the Northern Pacific railroad. The rich plac-

[1] W. Lindgren, *Annual Report*, U. S. Geol. Surv., 1900, pp. 107-187, and Lindgren and Drake, U. S. Geol. Surv., Folio 104, 1904.

[2] W. H. Weed, U. S. Geol. Surv., *Bull.* 213, pp. 88-89, and J. Barrel, U. S. Geol. Surv. *Professional Paper* 57.

ers of Silver creek were discovered in the early '70s, and the attention attracted by them led to the discovery of the veins. In 1902 the Marysville district had become the most important producer of the precious metals in Montana. At that time the Drumlummon mine had yielded a total of nearly $15,000,000, a larger amount than any other mine in the State, while the aggregate production of the mines of the district was estimated to have been double that amount. Mining has not been active of recent years due to the failure of the ore in depth.

The Marysville district embraces a mountainous country traversed by the continental divide, which there has the form of a broad soil-clad axis with an average elevation of about 7000 ft. The highest peak is Mount Belknap, 7329 ft., and the lowest valley, 4240 ft., is on Prickly Pear creek six miles distant. The region presents a mature mountainous topography. It is well dissected and there is an abundance of fairly steep slopes, rounded hill crests and a few cliff exposures. Marysville lies in an amphitheater 900 ft. high and about one mile in diameter cut out by Silver creek on the Atlantic side of the continental divide. Little Prickly Pear creek swings in a huge curve about the district, flowing first west, then north, and finally east.

The eastern and central plains of Montana are arid while the western and northern mountain ranges receive an abundant precipitation, mostly in the form of snow. Marysville lies in the transition belt between these two. The average precipitation is about 18 in. and snow lingers on the eastern slopes of the mountains till the first of April. The average temperature is 41 deg., with a 91-deg. maximum and 22-deg. minimum. The higher slopes which are covered with suitable soil support a dense coniferous vegetation with abundant grass in the open spaces. Below 5000 ft. or thereabouts the hills in the northern part of the district are bare of trees and almost devoid of grass save in the gulches.

### Geology and Ore Deposits

The Marysville district has a central mass of coarse-grained quartz diorite surrounded by thin, bedded argillaceous sandstones and slatey shales which, near the contact, have been altered to hornstones. The sedimentary rocks belong to the Belt group which is of Algonkian age. They were lifted into a dome toward the close of Cretaceous or the opening of Tertiary time and injected with widespread but small basic and intermediate sheets and dikes. Later, a great intrusion of quartz diorite occurred forming the Marysville batholith now exposed by erosion for a length of 2½ miles. This batholith is believed to be only an insignificant outlier of the great Boulder batholith which is situated a short distance to the south, and has an exposed area of over 2000 square miles within which is situated the Butte copper district. The invasion of the Marysville batholith was accompanied and succeeded by the formation of several sets of dikes, the earlier of which were pegmatitic and the later porphyritic. Mountain formation took place in Miocene or Pliocene time and was accompanied by an outflow of andesite. Since that period, the region has been undergoing continuous erosion.

The economically important ore deposits of the Marysville district are contact gold veins. They are within contact-matamorphosed sediments, either in close proximity to the quartz diorite batholith or adjacent to intrusive dikes. The veins are of later age than the dikes which were formed just subsequent to the intrusion of the batholith, and appear to have originated from peripheral shrinkage cracks through which hot waters escaped, depositing the ore in passing. Three distinct vein systems are developed near Marysville. The northeast-southwest system is exemplified by the North Star vein which cuts through the sedimentaries into the quartz diorite. The northwest-southeast system is prominent in the igneous rock but economically unimportant. The north-south system to which the Drumlummon vein belongs makes the third.

### The Drumlummon Vein

The Drumlummon vein is roughly parallel to the irregular igneous contact. It exhibits a tendency not to cut the larger intrusive masses which project into its path, but to be deflected around them. The vein has been developed for 3000 ft. horizontally and been found to split into two branches to the north and into several branches to the south. Vertically, it has been followed to a depth of 1600 ft. The walls are distinct and rather wavy, varying from two to 20 ft. in distance apart. The vein filling is mainly quartz inclosing angular fragments of the hornstone country rock. These fragments are sometimes distinct and unaltered, and at other times considerably decomposed. In the lower levels they sometimes occur entirely uncemented and constitute the only filling of the vein.

The ore occurs in well defined shoots, which pitch to the right as one looks down the dip of the vein. The structure of the ore differs from that of the waste filling in that the fragments of hornstone in the ore have been completely replaced and their former presence is only indicated by a banding of the quartz. No ore was found below a depth of 1000 ft. in the Drumlummon mine, although the development was carried to a depth of 1600 ft. The ore consisted of auriferous quartz, together with silver, copper and iron sulphides, fluorite and calcite. Gold made up 60 per cent. of the total value, and silver the remainder.

### Spotted Horse Contact Breccia

The Spotted Horse mine[3] is situated in the Judith mountains in central Montana. It is 1½ miles from the town of Maiden, and 15 miles by a good wagon road from Lewistown, the nearest railroad point. The mine was located by Anderson and Jones, in 1881. The locators sold to P. W. McAdow and B. Dexter, and Mr. McAdow became sole owner in 1883. He worked the mine successfully for five or six years, and then bonded it to the Jay Gould Mining Company, of Helena, capitalized for $500,000. This company worked the mine for a year and a half without success, when it reverted to Mr. McAdow, who again operated it successfully for several years and finally sold it, in 1893, to the Double Eagle Mining Company, of Chicago. This company also failed and the property was sold to J. L. Bright and A. L. Losinger and at present lies idle. The gold production of the Spotted Horse mine is said on good authority to be not less than a million and a half dollars.

The Judith mountains constitute one of the isolated mountain groups which occur in the plains country to the east of the main range of the Rocky mountains. In their midst lies a mountain park with an elevation of 6000 ft. Long, smooth slopes lead upward from the park basin to the surrounding peaks and divides. To the south, it slopes downward and gradually narrows to a V-shaped valley, known as Spotted Horse gulch, in which the Spotted Horse mine is situated. There are numerous springs in the upland basin, and grasses, flowers and pines grow luxuriantly, in marked contrast to the sparse vegetation of the semi-arid plains, which surround the mountain group.

The mountains are of laccolithic origin. The injection of porphyry into the sedimentary strata of the district produced a number of coalescing dome-shaped uplifts. Other intrusions of igneous rocks occurred, the most important being phonolite dikes. The sedimentary rocks involved were of wide variety, including conformable series ranging in age from middle Cambrian to Cretaceous. Subsequent erosion has removed portions of the sedimentary cover and in many instances exposed the porphyry masses of the laccoliths.

The Spotted Horse deposit is not a contact vein like the Drumlummon, but a mass of brecciated ore-bearing rock, which may be termed a mineralized contact breccia. It occurs where the quartz porphyry of one of the laccoliths projects in jagged masses into massively bedded, white, Mississippian limestone and the contact is brecciated. The ore is believed to have been produced during the period of cooling and crystallization of the deep-

[3] W. H. Weed and L. V. Pirsson, eighteenth *Annual Report*, U. S. Geol. Surv., 1898, Part III, pp. 437-623.

er seated portions of the porphyry by hot, acid, fluorine-bearing waters circulating in the contact zone. The ore deposit is extremely irregular. It was formed largely by replacement, and to a lesser extent by cavity filling. Fluorite and quartz have replaced angular fragments of the brecciated limestone and impregnated the massive limestone. The porphyry has also been mineralized in a minor degree. The ore has ranged in value from $17 to several thousand dollars per ton. It is oxidized to 400 ft., the greatest depth yet attained.

### Gold Associated with Fluorite

The oreshoots are small and irregular. They occur grouped together, and are called "boulders" by the miners. These "boulders" occur in the pure, partially crystalline limestone darkened by organic matter rather than in the shaley impure limestone, and the richest are found a short distance from the contact in the shattered limestone more often than directly at the contact. The richest ore is coarsely crystalline light gray limestone containing irregular masses of fluorite impregnated with gold. Other ores are of limestone of varying grain crossed by parallel fractures or seams of earthy material. The minerals which occur in the ore are fluorite, quartz, pyrite, gold telluride and native gold. The gold is intimately associated with the fluorite and its proportion usually increases with that of the fluorite, although this rule is not without minor exceptions. Native gold occurs in the richest ore in particles or small cubical masses. It is rarely as much as 1/32 in. in thickness and ⅛ in. across. The gold is always dark colored, and is generally platey and open textured or spongy. The form and condition of the gold indicate its derivation from a telluride. A telluride occurs with the free gold, but in too finely disseminated a form to permit of mineralogical identification. Pyrite occurs somewhat rarely and unaltered grains observed under the microscope are seen to contain small particles of what may possibly be a telluride.

### Cable Contact Metamorphic Deposit

The Cable mine[4] is situated in western Montana, 13 miles northwest of the city of Anaconda and 7½ miles beyond Brown's Siding, the terminus of the Butte, Anaconda & Pacific railroad. The mine was discovered in 1866 and a mill was built in 1867. A new mill was erected in 1887 and operated till 1891, when the property lay idle for a decade. Since 1902, prospecting has been carried on under the direction of F. W. and H. C. Bacorn, and a moderate production is recorded. The total production since the discovery of the mine has been between three and four million dollars.

[4]W. H. Emmons, U. S. Geol. Surv. *Bull.* 315, pp. 31-55.

The ore occurs in a zone of metamorphosed sedimentary rocks of Cambrian age. The Cambrian of this part of Montana rests upon the Pre-cambrian Camp Creek formation. Its lowest member is the Flathead quartzite, above which come in turn the Wolsey shale, the Meagher limestone and the Park shale. It is overlain by the Silurian-Devonian Pilgrim limestone. At the Cable mine two intrusive masses of granite have isolated and metamorphosed a long narrow belt of Meagher limestone, together with a little Wolsey shale.

The upper part of the Wolsey formation is a calcareous shale. Contact metamorphism has altered this to a rock composed of amphibole, garnet, magnetite, epidote and mica. The Meagher limestone has been altered to a marble with grain varying from wheat size to several inches in diameter. The coarser the grain, the more quartz, iron oxides, iron and copper sulphides appear. Magnetite occurs in large irregular bodies apparently related to the bedding planes. Calcite veins cut the granite, indicating that recrystallization continued after the granite had been solidified and fractured, but probably before it had cooled. Mica-pegmatite veins from 1 to 3 in. wide occur frequently at the granite and limestone contact, the magnetite and limestone contact or cutting the magnetite. Gouge-filled fissures later than the ore cut across the ore zone at various angles, effecting but slight displacement.

### Replacement of Limestone by Ore

The Cable deposit is a contact metamorphic deposit formed by replacement of limestone near granite contacts. It is not a contact vein like the Drumlummon nor a contact breccia like the Spotted Horse, but is a replacement deposit, similar to the well known type of contact metamorphic copper deposit, save that it contains less copper and more gold. Its formation is believed to have been directly due to the intrusion of the granite. The long, narrow zone of metamorphosed limestone and calcareous shale trending northeast between granite walls, constitutes the ore deposit. It has a length of 1800 ft., a width of from 80 to 360 ft., and an unknown depth.

The ore is so irregularly distributed in the sedimentary rocks that the entire zone must be prospected in order that no orebodies shall be overlooked. The shoots show little or no alinement. In shape they are approximately clyindrical or rudely spherical. The largest and richest orebody was an approximately cylindrical mass 50 ft. in diameter and 125 ft. in length, inclined at 30 deg. to the westward. Above, and connected with this, was a more steeply inclined shoot, which reached to the surface. About in line with these two shoots, but separated by a body of magnetite, was a third shoot. This group of shoots was about in the center of the ore zone; another group was further north, deeper and nearer to the north granite contact. This included another flat-lying, roughly cylindrical shoot.

Typical low-grade ore contains pyrite and pyrrhotite without visible gold associated with dolomite, containing a little iron, while rich ore contains visible free gold with tetradymite in calcite low in magnesia[5]. The principal gangue mineral is calcite, and there are smaller amounts of quartz, barite and dolomite. The primary metallic minerals occur generally as irregular masses in the gangue, but occasionally as alternating bands of metallic and gangue minerals. They are pyrite, chalcopyrite, pyrrhotite, tetradymite, arsenopyrite, marcasite, magnetite, specularite and gold. The secondary minerals found in the ore are hematite, limonite, manganese oxide, siderite, malachite, azurite, chrysocolla, bornite, chalcocite, copper and gold. Gold occurs finely disseminated in calcite, quartz, pyrite, pyrrhotite and chalcopyrite, as large grains associated with these minerals and intergrown with tetradymite, and less commonly as thin sheets parallel to the cleavage of the calcite. The magnetite carries from 20 to 80c. per ton in gold.

## Iron Blast Furnace Records

The following table gives the number of furnaces in blast, and the number of completed furnaces in the United States at the close of each year from 1873, compiled from the annual reports of the American Iron and Steel Association. The number idle each year is, of course, the difference between the number active and the total completed.

| Years | Active Furnaces | Completed Furnaces | Years | Active Furnaces | Completed Furnaces |
|---|---|---|---|---|---|
| 1873.. | 410 | 657 | 1892.. | 253 | 564 |
| 1874.. | 365 | 693 | 1893.. | 137 | 521 |
| 1875.. | 293 | 713 | 1894.. | 185 | 511 |
| 1876.. | 236 | 712 | 1895.. | 242 | 468 |
| 1877.. | 270 | 716 | 1896.. | 159 | 470 |
| 1878.. | 265 | 692 | 1897.. | 191 | 423 |
| 1879.. | 388 | 697 | 1898.. | 202 | 414 |
| 1880.. | 446 | 701 | 1899.. | 289 | 414 |
| 1881.. | 455 | 716 | 1900.. | 232 | 406 |
| 1882.. | 417 | 687 | 1901.. | 266 | 406 |
| 1883.. | 307 | 683 | 1902.. | 307 | 412 |
| 1884.. | 236 | 669 | 1903.. | 182 | 425 |
| 1885.. | 276 | 591 | 1904.. | 261 | 429 |
| 1886.. | 331 | 577 | 1905.. | 313 | 424 |
| 1887.. | 339 | 583 | 1906.. | 340 | 429 |
| 1888.. | 332 | 589 | 1907.. | 167 | 443 |
| 1889.. | 344 | 570 | 1908.. | 236 | 459 |
| 1890.. | 311 | 562 | 1909.. | 338 | 469 |
| 1891.. | 313 | 569 | 1910.. | 206 | 474 |

The remarkable point is that the total number of furnaces decreased by 183 in the period of 38 years, while in the same time the production of pig iron increased from 2,602,750 to 27,298,545 tons. In 1873 the average production of the active furnaces was 6348 tons; in 1910 it had increased to 132,517 tons of iron yearly. Nothing is needed beyond these figures to illustrate the great change in the size of furnaces and in metallurgical methods.

[5]W. J. Sharwood, *Economic Geology*, VI, 1911, p. 29.

# Tin Mining and Milling in Bolivia

By Miltiades Armas *

*Most of the mines are wanting in systematic development, but many of the mills are equipped with modern and improved devices.*

*General manager, La Paz Mining Company, La Paz, Bolivia.

NOTE—This is the last of a series of three articles on the tin industry of Bolivia. The preceding articles relate mainly to the genesis and occurrence of the tin ore.

Bolivia, being entirely landlocked, is dependent upon her neighbors for communication with foreign countries. The natural outlets are westward to the Pacific, via Mollendo, Peru, and Arica and Antofagasta, Chile.

The ports just named are connected with La Paz by three railroads: The Antofagasta-Oruro-La Paz R.R. (1161 km.); the Mollendo-Arequipa-Puno-Lake Titicaca-Guaqui-La Paz R.R. (856 km., of which 237 km. are covered on Lake Titicaca by steamers from Puno to Guaqui), and Arica-La Paz R.R. under construction (438 km.). Branch lines to Cochabamba and Potosi are being constructed. Unfortunately a great deal yet remains to be done, particularly as regards roads to the various mining districts.

The Bolivian government encourages in every possible manner private enterprise in the construction of roads. The difficulty of transportation often handicaps the miner in developing the wonderful mineral resources of Bolivia. Frequently he has to discard properties, otherwise valuable.

HAND PICKING AT CARMEN MINE, HUAYNA-POTOSI

CONCENTRATING FINES IN A LONG BOX

### LABOR SUPPLY AND WAGES

Bolivia's population is sparse; only about 10 per cent. are whites, the remainder consisting mostly of half-breeds (*cholos*) and Indians. The Bolivian workman is good natured, but most improvident, a spendthrift and prone to *fiestas*. As long as he gets enough food, and especially drink, he does not care to work more than is absolutely necessary. The engineer condemned to forced inactivity and loss of time on account of their ever recurring *fiestas*, will appreciate the remark that the natives believe that God created day for rest, and night for sleep! Yet the natives, mostly Indians accustomed to the high altitudes of the country, are often indispensable for mining work.

Four years ago, during the boom in tin, when a considerable influx of Chilean capital took place, railway construction increased wages beyond reason; a miner who but a few years before that was making $1 to $1.20, in 1907 earned as much as $2.80. In such circumstances, for many mines it was a question whether they could operate at all. Fortunately, conditions have since reverted to their normal state.

### POWER

Few are the mines which are blessed with hydraulic power; they are situated in the heart of the Andes near glacial lakes and streams, but, on the other hand, suffer the disadvantage of difficult transport. Most of the mines, and the most productive ones, far from possessing hydraulic power, have hardly the necessary amount of water for concentration. The power at these last mines is procured from such fuel as llama dung (*taquia*) and some resinous plants, *yarreta* and *queñua*, which grow in high altitudes, but are of slow growth, and not abundant.

Coal at present costs about $45 per ton, and often even $60. The efficiency of the *taquia* as a steam fuel is as 1:6 compared with coal, for its calorific power is about 1200 calories. In practice, the combustion being more defective, the efficiency is sometimes reduced to 7 tons of *taquia* to 1 ton of average Australian coal. The average price of *taquia* is from $4.50 to $5.60 per ton.

Lately, in a number of mines, oil and gas engines have been used. Gas engines have superseded oil engines, because oil is difficult to transport, and easy to pilfer on its way to the mine. The gas engines use anthracite and are giving very satisfactory results. At an altitude of 15,740 ft., at the Chorolque bismuth-tin mines, a gas engine of 60 h.p. at sea level developed 48 h.p., with a consumption of 0.33 kg. of anthracite per horsepower per hour; under certain conditions it required 0.45 kg. per horsepower-hour.

### PROTECTION OF CAPITAL

The mining laws of Bolivia are liberal; concessions are granted with equal freedom to natives and foreigners, and without all the difficulties and formalities usual in Europe. The law of mining concession is based upon the principle of priority of petition, and is so shaped as to protect miner and capital alike. Certain imperfections give rise to law suits, but with good titles in hand one finds abundant protection from blackmailers.

### CHARACTER OF THE TIN MINES

Few mines in Bolivia can boast of preparatory work, that is, a proper development of the deposit, the blocking out of ore on four sides, etc. The native miner, as a rule, is after rich stringers and follows them in all their capricious sinuosities; he removes the richest mineral with the aid of little boys or men, who carry out the ore on their backs with wonderful agility. Before long, the crosscuts, inclined shafts, drifts and holes traverse the orebody in all imaginable directions. He unconsciously, in a fashion, develops his mine; he prepares it so as

to enable an engineer to estimate the importance of the formation, but there is no ore in sight, in a European sense. His means are too limited for regular mine-development work, even if he knew its importance and necessity. Some of the most remunerative properties, which have been producing now for a score of years and more, can hardly be said, even today, to be properly developed or to possess a definite amount of ore in sight. In most of the mines, development is ahead of the actual exploitation by only a few months.

An engineer sent to examine a mine for a purchaser, if he relies only on the blocked-out ore, is sure to return disappointed. Many mines in the Oruro district today, and among the most productive ones of Bolivia, were turned down 10 years ago for the lack of ore in sight, but ever since have been yielding splendid returns, and are far from being exhausted. An engineer in Bolivia cannot go by fixed rules. Knowledge of vein formation and some geological insight are necessary, together with a patient study of the region and the contiguous mines, which, as a rule, throw a great deal of light on the particular mine he is examining.

### Grade of Bolivian Tin Ores

It is common in Bolivia to hear that such or such a mine yields ores with 10, 15 or 20 per cent. tin. Such statements are misleading, for there is no mine with such ores; upon closer scrutiny one invariably finds that the grade mentioned applies to the *palla*, or sorted ore, from which more than half or even three-quarters of the waste rock has been taken out, or that it is only a rich stringer that is referred to. Even Europeans commit this mistake, and the owners of some of the most productive mines, such as Huanuni and Llalagua, themselves hardly know the real average grade of their ores.

From my experience and that of competent engineers who examined most of the Oruro district, such mines as Llalagua, Huanuni, Negro Pabelon, Uncia, Morococala, etc., there is no mine whose ores exceed 4 per cent. tin, except one, which is really a sort of bonanza, of which the ores have an average grade of 6 per cent. tin. As a whole, Bolivian ores average 3 per cent. in metallic tin.

### Primitive Treatment Methods

The treatment of ores from the oxidized zone, containing little or no sulphides, is simple, but not so when the sulphides prevail, in which case tin is in the state either of stannite or as cassiterite in minute crystals surrounded by a mass of pyrites. When the ores contain too much sulphides, a preliminary washing becomes necessary in order to oxidize the sulphides, or transform the tin sulphides into oxide.

When roasting is necessary, the concentration plan is first to crush the ore, eliminate as much as possible of the waste by a preliminary concentration, then roast the products, which are recrushed in order to free the cassiterite from the iron oxide, and finally reconcentrate them on tables or similar concentrating apparatus. The product is *barilla*, containing 55 to 70 per cent. tin, which is shipped to Europe in bags of 50 or 100 lb. each.

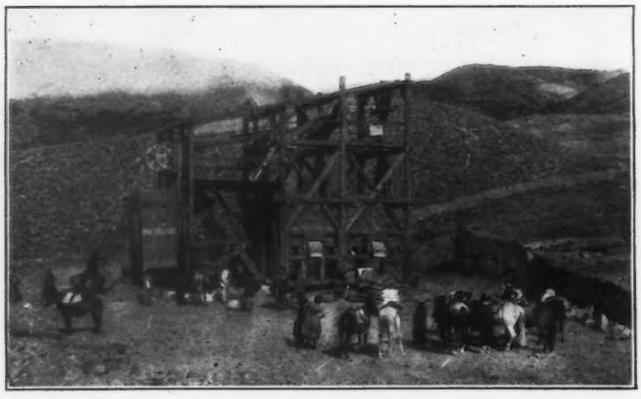
Crushing is done by *quimbaletes*. These are made often out of hard stone, but also of iron plates. In shape it resembles a truncated pyramid with a convex base, under which the ore is crushed on a hard floor (stone or iron plate) by a man who gives it a gyratory and a rocking motion.

The crushed ore, after hand screening by women, is jigged by hand, and two classes of concentrates are obtained. They are recrushed, passed through the jig again, and the fines treated in long, inclined boxes, where they are screened and continuously raked in a direction opposite to a small water current, which gradually carries away the waste particles, the heavy particles of cassiterite adhering to the bottom of the box near the head. These operations repeated give products of 58 to 65 per cent. tin. The losses are heavy, often 50 per cent., and only rich and well sorted ores can be treated thus with any possible profit.

### Modern Concentrating Mills

The foreign companies, and some of the best mines belonging to natives, have erected modern mills, with machinery imported from the United States and Europe, and showing a great variety of types. In the choice of machinery, the question of transport is of the greatest importance, and may often influence an engineer to adopt a type of machinery different from what he would have desired.

The choice of machinery depends largely upon the nature of the ore to be treated. In most cases cassiterite occurs in rather coarse crystals, but often also is found in minute crystals incased by a ferruginous gangue. Not seldom the cassiterite particles are surrounded by a pyritic mass, or form the core of an aggregation of minute crystals of pyrites. In certain mines tin is in the state of stannite, or as sulpho-antimonite of tin, silver and lead (andorite), or other complex compound. The gangue consists often of quartz and iron oxide of mean hardness, but often also, as in the case of impregnations in quartzites, etc., the ore is very hard. In Araca, for instance, where the ore is extremely hard, the Grüson ball mill gave bad results both as to capacity and as to wear. Stamps would have done better.



Tramway Station, Huayna-Potosi

Erecting Tramway Pillar, Huayna-Potosi

Although I am not an enthusiast on the stamp mill, in a far-off country where skilled labor is scarce, I have found the ordinary California gravity stamp to be well suited, for aside from its simplicity and ability to stand rough handling, it gives satisfactory results with ores requiring fine crushing.

### Ocavi Concentrator

The Ocavi mill uses gravity stamps of 950 lb. The ore, after passing through a careful hand sorting, is crushed in a 7x10-in. Blake crusher, and then goes to the stamp mill. The concentrating tables are the Wilfley No. 5, the Sperry buddle, and ordinary, round, cement-floor buddles, besides the other accessory apparatus, such as three-compartment Harz jigs, a Huntington mill for regrinding, Callow

screens, conical unwatering tank, impact screens, etc. The peculiar feature of the Sperry buddle, or vanning buddle for slimes, is that it combines with the circular motion a vanning motion, together with a variable slope, which can be adjusted to suit the ore. The surface of the table is made of rubber. Two classes of concentrates are obtained. The apparatus is rather complicated and liable to get out of order. The motive power was a Hornsby oil engine, but it has been replaced by a steam engine as more economical. The fine slimes go to the cement buddles and are treated there successively; that is to say, the heads of one buddle are treated on another and the middlings on a second, and the operation is repeated. The first slimes go to settling tanks and reservoirs, and are worked over again by Indian contractors.

In Oruro, the best mills employ stamps for crushing, Wilfley or Ferrari tables for concentration, and round buddles for the fine slimes. In many of the mines, gas engines have taken the place of oil or steam engines, with good results.

### Araca Mill

The owners of the Araca mines have overcome great difficulties in that isolated locality, in erecting a concentration mill and an aërial tramway for the transport of their ores from an altitude of 17,000 ft. to their mill, say 15,500 ft. elevation. The motive power is hydraulic. The mill consists of a Grüson ball mill, jigs, classifiers, Ferrari tables and Linkenbach round buddles. These latter tables give excellent results on the very fine ore, and are most appropriate for tin-ore slimes. The diameter of the Linkenbach table used in Araca is 7 m.; its capacity per hour is 600 to 800 kg. of dry slimes; the water consumption is 3 l. per sec., and of energy only ¾ horsepower.

The ores treated in the mill undergo a previous hand sorting, which brings their grade to about 6 or 8 per cent. tin; the average grade of the ore as it comes from the mine does not exceed that of the other mines of Bolivia. The grade of the concentrates obtained is 64 per cent. metallic tin.

The cost of 100 lb. of concentrates (*barilla*) is about $7.40 at the mill. The *barilla* is carried from the mill to La Paz by llamas or mules.

### Huayna-Potosi and Milluni Concentrating Mills

The mines of Huayna-Potosi and Milluni each have a separate mill; in both the motive power is hydraulic, the water being obtained from small lakes at the foot of glaciers.

The size of these lakes often exceeds one kilometer in diameter. In both mills Cornish pneumatic stamps are employed. The capacity of each stamp is 32 tons per 24 hours through an 18-mesh screen. The cost of repairs, especially to the screens, is high. After classification, the products are directed to Wilfley tables and to round buddles. The pyrites are roasted and recrushed in Reynolds chilean mills of 15 tons capacity per 24 hours, and reconcentrated.

In Huayna-Potosi most of the bismuth is contained in the iron; there the ore, after roasting, whereby the iron oxide is rendered magnetic, passes through magnetic separators. The concentrates of Huayna-Potosi contain 50 per cent. tin; they are shipped to Havre, France, where they are retreated and the bismuth extracted. The Milluni concentrates contain no bismuth, and the degree of concentration is as high as 65 per cent. tin. The Huayna-Potosi concentrates contain impurities, such as lead, antimony, and sulphur.

### Cost of Mining and Milling

It is evident that the cost of mining and milling varies widely in the different regions of the country, but in order to convey a relative idea I will give only two examples, from two mines wide apart, without mentioning their names.

Hand Jigging Tin Ore

### Mine No. 1

Motive power, hydraulic. Cost per ton ore:

| | | |
|---|---|---|
| Mining | 8.60 Bol. | |
| Conveying from mine to mill | 0.12 | |
| Salaries of chief miner and assistants | 1.00 | |
| Mine material, dynamite, etc | 2.55 | |
| Total mining | | 12.27 |
| Sorting, hand picking and handling | 1.23 Bol. | |
| Milling | 0.95 | |
| Weighing, drying, bagging, etc | 0.20 | |
| Material and repairs | 1.44 | |
| Assaying | 0.04 | |
| Millman and assistants | 1.24 | |
| Total milling | | 5.10 |
| Manager, assistant, office, etc | 0.78 Bol. | |
| Mine taxes | 0.14 | |
| Total general expense | | 0.92 |
| Total cost | | 18.29 |

18.29 bolivianos is equivalent to $7.27 U. S. currency.

The concentrates contain 64 per cent. of metallic tin. In Bolivia they calculate on the Spanish quintal of 100 lb., and a quintal of *barilla*, in this case, costs at the mine about 17 bolivianos.

Transportation from the mine to Europe, per quintal of *barilla*, can be itemized as follows:

| | |
|---|---|
| Mine to Guaqui, by mule and railway | 4.60 Bol. |
| Guaqui to Mollendo (by rail and steamer | 1.30 |
| Mollendo to Europe | 1.00 |
| Duties (export) average | 2.00 |
| Commissions, insurances, etc | 1.40 |
| | 10.30 Bol. |

This is equivalent to $4.01, or $88.22 per ton of concentrates.

### Mine No. 2

No hydraulic power. Fuel is kerosene, or *taquia*. Cost per ton:

| | | |
|---|---|---|
| Mining | 4.13 Bol. | |
| Materials, steel, dynamite, etc | 1.26 | |
| Walling, filling | 1.60 | |
| Total mining | | 6.99 |
| Fuel | 1.00 Bol. | |
| Milling | 2.46 | |
| Drying *barilla*, bagging, etc. | 0.80 | |
| Materials, repairs, etc | 0.50 | |
| Assaying | 0.10 | |
| Total milling | | 4.86 |
| Carpenter, mason, blacksmith, foreman | 1.20 Bol. | |
| Accountant, storekeeper | 0.40 | |
| Road repairing, legal services | 0.30 | |
| Various incidentals | 0.40 | |
| Total general expense | | 2.30 |
| Manager and assistant | 1.60 Bol. | |
| Chief miner | 0.25 | |
| Various | 0.15 | |
| Total administration | | 2.00 |
| Total cost | | 16.15 |

Equivalent to $6.29. Freight and duties from the mine to Europe, including insurances and commissions, per 100 lb. of *barilla*, amount to 9 bolivianos, or $3.51.

### Export Duty

Bolivia charges an export duty on each quintal of 100 lb. of *barilla* (tin concentrates) exported, irrespective of its grade in tin. The duty varies with the price of tin in London, as follows:

| London Quotation £ per Long Ton Tin | Export Duty Bolivianos per 100 Lb. *barilla* |
|---|---|
| £100 | 0.90 |
| 100–110 | 1.00 |
| 110–120 | 1.15 |
| 120–130 | 1.30 |
| 130–140 | 1.45 |
| 140–150 | 1.60 |
| 150–160 | 1.75 |
| 160–170 | 2.00 |

The total amount of tin concentrates exported from Bolivia in 1906 was 29,373.5 tons, having a commercial value of $14,099,298. In 1907 the production amounted to 27,677.7 tons, valued at $11,956,801.

Most of the mining is done on the high plateau region, at an altitude of 12,000 to 16,000 ft. At such altitudes, although the region is in the tropical zone, the climate is cold and healthy. Naturally, malarial fevers, mosquitoes, etc., are unknown. The air is so pure that people with weak lungs are generally cured. The illness to be dreaded is quick pneumonia. Clothing must be woolen and rather heavy. People with weak hearts should avoid the country as the high elevation may prove fatal.

# Mining Coal at Morgantown, W. Va.

By R. B. Brinsmade *

*The Upper Freeport seam outcrops three miles east of Morgantown but is 500 ft. deep at the city. Elkins Mines Nos. 1 and 2 described as typical of mining practice in this seam.*

*Professor of mining engineering, West Virginia University, Morgantown, W. Va.

At Morgantown, in the Monongahela coal basin, the Pittsburg seam outcrops, and its exploitation has already been described[1], but the Upper Freeport seam is about 500 ft. beneath the city. The basin, however, rises so sharply to the east that the latter seam reaches the surface only three miles away at Richard, a point one mile north of the main line of the Morgantown & Kingwood railroad, which runs southeast up Deckers creek into Preston county.

At Richard is opened the Elkins mine No. 1; across the railroad at Rockford is the mine of the Connellsville Basin Coal and Coke Company, while at Bretz, 10 miles farther east along the railroad, is the Elkins mine No. 2. The last mine is now connected with the Elkins mine No. 6, driven through the hill from Masontown. As typical examples of mining practice will be described the No. 1 and No. 2 mines of the Elkins Coal and Coke Company.

### Elkins Mine No. 1

The Elkins mine No. 1 is a drift operation which was started in 1901 to develop a large tract lying north of Deckers creek in the Cheat mountains. The normal daily output is about 400 tons of coal, which is coked at the mine ovens and shipped direct to the various consumers.

The coal outcrop is 100 ft. above Deckers creek and a typical section of the seam is as follows:

Sandstone roof; black "draw" slate, 2 ft. 4 in.; cannel coal, 6 in.; bony coal, 8 in.; main bench coal, 2 ft., 10 in.; little slate, 2 in.; mining ply coal, 1 ft.; big slate, 1 ft. 4 in.; bottom coal, 1 ft. 4 in; fireclay, 10 ft.; irony limestone 8 ft. Only the main bench and mining ply layers, aggregating about four feet, are now mined by the room-and-pillar system. The rooms are four feet high, from the big slate to the bony coal, while the entries are made about six feet above the track by brushing down the roof. The little slate is mostly gobbed and the crude coal as loaded is cleaned by the dry process.

### Room and Pillar System Used

The separation of coal from slate and bone is done in a Bradford breaker and the clean coal is crushed in a Williams patent pulverizer as described in more detail for Elkins mine No. 2. The crushed coal is raised to bins under which run the electric larries that distribute it to a single line of 150 beehive coke ovens. The seam dips 14 per cent. at the pit mouth. The main slope is straight and at an angle from the dip to give it a grade of about 8 per cent. which becomes less as the seam flattens out with depth. Like the main slope the cross or flat entries are double and are turned off at a sufficient angle from the strike to give a grade of about 1 per cent. in favor of the loads; they are at 2000-ft. intervals along the dip. The butt entries are turned off from the flats to the rise and were formerly double but are now triple, so that the central heading can be used for an airway and rooms turned off in both directions along the strike of the seam.

The rooms, the center lines of which are placed 45 ft. apart, are driven 25 ft. wide for 225 ft. but taper down for the 25-ft. length of neck. Two opposing rooms, or 500 ft., is the distance between adjoining butt entries and the latter are separated by 50-ft. pillars. All entries are cut 16 ft. wide so their roof brushings can be gobbed at one side and leave a working heading about eight feet wide in the clear. Crosscuts are driven 60 ft. apart both in room and in entry pillars.

### Chain Undercutters in Entries

Two Sullivan longwall electric chain undercutters are used for entry driving. The cut follows the floor in the mining ply layer of coal and is 16 ft. wide and five feet deep. The two machine-men also load the coal, gob the waste and advance the entry one cut per shift. A cut is usually shot down by one row of four 1¼-in. holes, bored on an upward inclination by a breast auger to a depth of about five feet. One foot of black powder, fired by a squib, is used in each hole.

The rooms are cut by hand-pick, and the slot is made just above the little slate for a depth of three feet. The main bench layer is then shot down into the cut and the mining ply layer is shot off the floor. This completes the round of holes, which are generally two above and two below, of 1¼-in. diameter by three feet length, for a 25-ft. room. Two miners usually break and load one cut or 10 to 12 tons per shift. Some time ago, a number of punchers were tried in the rooms, but the fact that their cut was necessarily made along the floor in the mining ply coal made the broken coal much more difficult to sort from the little slate, so they were not adopted. Drawing of pillars is done by retreating from the boundary toward the main slope, leaving reserve pillars to protect such flat entries as need to be kept open.

Three-quarter sets are used in timbering the entries at a few soft places, but usually one row of props between the gob and the track is sufficient. In the rooms, two rows of props are set between the inbye rib and the track, which follows the outbye rib; these are inserted carefully as the roof of bony coal is apt to shell off.

### Gathering Motors and Rope Haulage

The mine cars are wooden, with loose wheels and hold 2800 lb. of coal. They are handled by three 5-ton Jeffrey gathering locomotives to the partings at the main slope, which are long enough for 20 cars. The main slope is single track and 16 cars are hoisted in one train with a dragbar behind, at the rate of about six miles per hour. The steel hoisting rope is ¾-in. diameter, common lay, and is wound up by a Robinson duplex engine (10x21 in.), over a 5-ft. drum. Signaling is done by electric bell.

The tipple is near the pit mouth. The cars are run into it by gravity and are emptied into storage bins by a Phillips crossover dump. The empties then run down hill through an air course to the top of the main slope where they are coupled in trains for gravity descent.

The main slope is 3000 ft. long, and is extended for exploration 1500 ft. below the present workings. This extension is now only used as a sump and near its bottom the main drainage pump is placed on a truck, so it can be easily hauled up in case of an accident. The pump is a Yough-Porter duplex, with 8-in. plungers, a 24-in. stroke and a capacity of 400 gal. per min. It is geared down from an Allis-Chalmers electric motor of 30 h.p. and 900 r.p.m. The water column is a four-inch wooden stave pipe with steel hoops.

### Ventilation by Reversible Fan

Passages for overcasts in the ventilating system are blasted out in the draw slate over the entries. They are floored with concrete, supported on steel girders, and walled off with concrete for the main and flat entries and enclosed with double plank in the other entries. Crosscuts, except those nearest the face, are walled

[1]Eng. and Min. Journ., June 11, 1910.

off with masonry in the main and flat entries and with double plank in the butt entries and rooms. Fireproof curtains are used at the minor splits except when a strong draft requires a door.

The Guibal steel fan is 20 ft. diameter by eight feet wide and was made by the Monongahela Fan and Engine Company. It is coupled direct to a single slide-valve engine, 10x38 in., and turning 54 r.p.m. The casing is so arranged as to reverse the current and considerable power is saved by using forced draft in winter and exhausting in summer. In winter, the fan-engine exhaust is turned into the current so as to dampen the otherwise dry mine air and lessen the danger of igniting coal dust. The dust is the chief thing to be feared here, as the long outcrop has permitted practically all the firedamp of the seam to escape long ago.

There are three 6x15-ft. return-tubular boilers, made by the Erie City Iron Works. They are hand-fired with breaker and oven refuse and are fed by a 7½x 5x6-in. Worthington duplex pump. For electric power for the breaker, ovens, shops, locomotives and coal cutters, there is a General Electric direct-current generator, of 250 volts and 769 amperes, direct-connected to a Fleming engine of 300 h.p. On the latter is an Austin "B" steam separator and a Bundy steam trap. A 4-h.p. motor, speed 600 r.p.m., runs the stone and emery grinders, a drill press and a fan for blowing the two smithy forges. For car repair there is a pit under the track, 12 ft. long by 5½ ft. deep.

### American, Slav and Italian Labor

The mine is operated, when busy, six day shifts per week and the workers are American whites and negroes with many Slavs and Italians. A typical day's force was: A foreman and assistant; 80 miners and trainmen; six tipple and breakermen; three mechanics; four engineers and firemen; six trackmen and teamsters; and 37 coke makers; total 138 men. Most of the men reside in the company's cottages of which there are 60, built of wood, with three to five rooms apiece. They are electric-lighted and spaced well apart.

Little sampling need be done except for the sulphur content of the coke, which is sampled by taking a piece representing the full height of the oven charge. In case too much sulphur is found, it is obviated by finding its origin in the mine. This is done by vertically grooving suspicious producing faces and cutting the groovings down on canvas, by quartering, for a laboratory sample.

### Elkins Mine No. 2

The Elkins mine No. 2, ten miles east of mine No. 1 and over the Chesnut Ridge anticlinal, is opened on the western rim of the Masontown coal basin. A typical section of the Upper Freeport seam here, as measured by me, is as follows:

Sandstone roof; draw slate, 2 in. to 4 ft.; cannel coal, 12 in.; bony coal, 12 in.; main bench coal, 2 ft. 11 in.; little slate, 2 in.; mining ply coal, 1 ft. 2 in.; big slate, 10 in.; bottom coal, 1 ft. 6 in.; fireclay floor, — . Only the four feet of coal between the big slate and the bony coal is now being extracted, so rooms and entries are the same hight as in Mine No. 1.

The capacity of the breaker is 150 tons per hour, and the structure is situated near the pit mouth as shown in the accompanying illustration. The mine cars are tipped, on a Phillips crossover dump, into a storage bin whence the crude coal is shoved by an automatic piston-feeder into a Bradford cleaner, 11 ft. long. This machine is like a cylindrical trommel, having a screen with one-inch square holes. It is fitted with longitudinal radial internal wings, so that the passing material will be lifted up during the rotation of the trommel and dropped hard on the screen. This shock breaks up the softer substance (coal) so that it passes through the holes, while the harder slate and bone are unaffected and slide to waste over the end of the cleaner.

The undersize or clean coal enters a Williams patent pulverizer to prepare it for coking. The pulverizing destroys the horizontal bedding laminate of the coal, which would prevent it from assuming the vertical columnal structure, so distinctive a feature of the best beehive coke.

### Coke from 267 Beehive Ovens

Along the contour of the hillside, below the pit mouth is one row of 267 beehive ovens. One oven is 12 ft. inside diameter, and it makes one 72-hr. and two 48-hr. runs in seven days for an average output of 12 tons of coke weekly. For charging the cleaned coal, there are three 10-ton steel, electric larries, which carry one charge at a time of 5½ tons for the 48-hr. and of 6¾ tons for the 72-hr. run of coke.

Tipple and Coke Ovens at Elkins Mine No. 2 at Bretz, W. Va.

In the block that is still hand-drawn, one laborer tends six and draws three ovens per day. Quenching is done by inserting, at the oven's center, a spindle carrying a perforated pipe, which whirls horizontally by the reaction of its issuing water spray. For machine-drawing, the Covington coke drawer is used; it handles 40 ovens per day and enables four men to do the work of 13 by the hand method. The drawn coke falls on the Covington truck-conveyer, which discharges over a small grizzly into a gondola car for shipment. The grizzly undersize is largely burned in the mine boilers.

As the grade of the seam here is only 5 per cent., instead of 14 as at Mine

No. 1, there is no difficulty in driving the main entry along the dip; otherwise the general layout is the same with double-flat and triple-butt entries. The rooms are turned off from each side of the butt entries along the strike of the seam at 50-ft. centers and work on the face of the coal; the face cleat here follows the dip. The rooms are 30 ft. wide except for the taper of the 25-ft. length of the neck.

### Hand Pick Only in No. 2

The coal is cut only by hand pick, making a groove along the top of the little slate as already described. This system is well adapted to the entries here which are only 10 ft. wide. The brushings from the roofs are hauled to the surface dump, instead of being gobbed alongside. Timbering and robbing the pillars are pursued by methods like those of Mine No. 1.

The coal cars are steel, with a weight of 2000 lb. and a capacity of 3500 lb. of coal. They have side brakes and loose wheels; many have the Jarvis-Midland roller-bearing axle. As at Mine No. 1, the track is 44-in. gage, fitted with 60-lb. rails in the main entries and 30-lb rails in the others. In the rooms where motors do not enter, the rails are 12 lb. per yard. The trains are handled by Jeffrey 10-ton electric locomotives, which have a 4000-lb. drawbar pull at six miles per hour, and they operate at 250 volts pressure.

### Ventilation and Power Plant

The ventilating fan is of Guibal type, 16 ft. diameter by 8 ft. wide and direct-connected to a 50-h.p. horizontal steam engine running 60 r.p.m. It is set in a reversible casing, so it can be arranged to force air in winter and exhaust it in summer. At the time of my visit, there were three main splits for the air passing respectively 32,000, 18,000 and 5000 cu.ft. per min. and having a total circulation of 55,000 cubic feet.

There are two 250-volt generators, direct-connected to Fleming high-speed engines, to supply direct current for haulage, light, shops and the breaker at Mine No. 2. For Mine No. 6, alternating current is obtained from one Allis-Chalmers direct-connected generator and transmitted at 2200 volts to the other side of the mountain. There it is used at once in the motors for the fan and the breaker, but is stepped down to a 250-volt direct current for haulage.

There is a new plant of water-tube boilers with the old return-tubular batteries as relays. The fuel used is a mixture of coke breeze and breaker refuse. The draft is forced and automatically regulated by the Parsons steam-jet system.

## Diamonds in British Columbia

Special Correspondence

In recent months, mention has been made several times in the Journal of the finding of diamonds in British Columbia, and in this connection the following notes are of interest. During the year 1910 members of the Geological Survey of Canada spent some time in the field in the Tulameen district of British Columbia, and some interesting discoveries were made relative to the occurrence of diamonds in that district. The diamonds were found in a sample of chromite taken from the peridotite of Olivine mountain, which is situated about seven miles west of Tulameen village. It is the first-recorded discovery of diamonds in Canada, either in the solid rock or in placer. The peridotite forms an elongated body about 2½ miles long and one mile wide, extending from the summit of Olivine mountain northward across the valley of Tulameen river to Grasshopper ridge, and the total area inclosed is about 2.8 sq.m. It is surrounded on all sides by pyroxenite, into which it passes by a gradual transition. These two rocks have been thrust through a series of interbedded volcanic rocks, limestones and argillites, which are believed to be of Triassic age. The peridotite contains only two constituent minerals, olivine and chromite, and the chromite in which the diamonds were found is not evenly distributed in the rock mass, but occurs in short, irregular vein-like segregations an inch or more in width, in irregular masses or in small grains disseminated throughout the rock. In all cases it is doubtless a product of differentiation in the molten magma, during cooling.

In some places the peridotite is altered to serpentine, but in many places it is quite fresh and shows little evidence of decomposition. It is of the same family of rock as that to which the matrices of the South African and Arkansas diamonds belong, but it differs slightly from the rock in the latter places in constituent minerals and in the degree of alteration undergone.

The diamonds, which so far have been obtained by the breaking down of chromite in laboratories, are small and the largest is about the size of an ordinary pinhead. Under the microscope they were observed to be clear and bright and apparently of excellent quality. Some have a faint, yellowish color; others are massive, opaque and grayish-black and are presumably the variety carbonado. All of the stones found so far have been associated with the chromite of the peridotite and not with the olivine, and if this association holds true throughout the mass of the rock, it is believed that the diamonds will be found unevenly distributed, and for that reason, if for no other, their extraction would be a difficult problem. Another difficulty to be overcome lies in the fact that the rock is so fresh and hard that the South African methods could not be employed; mechanical methods are objectionable for several reasons and chemical processes are slow and expensive.

It is possible that the finding of diamonds in Canada is the missing link in the solution of the occurrence of diamonds, in a small way, in the glacial drift in Illinois and Ohio, since it is known that much of the material of this drift has been derived from rock in Canadian territory and has been carried southward by glacial action.

## Supplies and Prices of Monazite

A correspondent of the London *Financial Times* writes: "For a considerable time past negotiations have been proceeding among the principal European manufacturers of thorium with the view of coming to an arrangement by which production and prices could be regulated, but these have at length been abandoned, as unanimity was found to be unattainable in existing circumstances. The supply of thorium was at one time a virtual monopoly under the control of a powerful Continental syndicate, but the corner has at length been broken, and the industry has fallen on evil days from the producer's point of view. Prices have steadily declined for two or three years, and are not unlikely to go considerably lower. This declining tendency is directly attributable to the glutting of the market with monazite sand, the principal raw material from which thorium is produced. The supplies of this sand were entirely controlled by the Thorium Syndicate. Inordinate greed proved the syndicate's undoing, however, for the exorbitant prices charged forced the leading makers of incandescent mantles, including the Welsbach Incandescent Light Company and the German Incandescent Gas Company to exert themselves to obtain independent supplies at all costs. In this they were successful and prices fell rapidly. Practically the whole of the supply of monazite sands comes from Brazil, and thorium nitrate is manufactured only in the United States and on the Continent of Europe. The yearly consumption of monazite sand for the manufacture of thorium is placed at between 2000 and 2500 tons, but for some years the supplies have been equal to double the consumption. The contract between the Brazilian government and the Thorium Syndicate has now expired and a new lease of the fields is about to be arranged. There are numerous offerers, and as the Brazilian government is not likely to allow any monopoly to acquire control of the supples, a further flooding of the market and consequent decline in prices is feared."

## PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

John Hays Hammond has returned from Europe.

Prof. H. S. Munroe has returned from his European trip.

J. Morgan Clements, of New York, is in the West on professional business.

S. F. Shaw has resigned as manager of the Montezuma mines of Costa Rica.

J. A. Burgess is superintendent for the Nevada Wonder Mining Company, at Wonder, Nevada.

Morton Webber, mining engineer, New York, is in Mexico on examination work for New York interests.

W. Weston has finished the professional business on which he was engaged in Mexico, and has returned to Denver.

Pope Yeatman is in Nevada and Utah on a tour of inspection. He is expected to return to New York about Sept. 5.

S. E. Bretherton, mining engineer, San Francisco, has been in Plumas county examining land for gold-dredging purposes.

Frederick L. MacLeod, of Glasgow, Scotland, has been elected a director of the Arizona Copper Company, Ltd., from Oct. 1 next.

F. S. Witherbee, president of Witherbee, Sherman & Co., sailed from New York, Aug. 16, on the S.S. "Lorraine," for a European trip.

William G. Sharp, president of the U. S. Smelting, Refining and Mining Company, is making an inspection of the company's works.

Carl F. Dietz and Dyke V. Keedy, of Boston, have gone to Nova Scotia to examine two copper properties in the interest of Halifax men.

Judge Fishback, of Chicago, recently visited the Lake-of-the-Woods district, Ontario, where he owns a controlling interest in the Ophir gold mine.

H. W. Hardinge has just returned to New York from an extended trip in the West, and expects to go to Europe on professional business next month.

Francis Church Lincoln, mining engineer, will leave New York about Sept. 1 to take up his duties as assistant professor of mining at the University of Illinois.

Francis A. Thomson, professor of mining and metallurgy at the State College of Washington, Pullman, Wash., has returned from examination work in the Ten Mile district of Idaho.

J. M. Clark, King's counsel, of Toronto, and a leading authority on mining and constitutional law, has been elected a member of the honorary council of the North British Academy.

W. R. Ingalls intends to start, Sept. 16, on a western trip, during which he will visit New Mexico, Arizona, California, Nevada, Utah and Montana, returning to New York about Nov. 15.

A. F. Kuehn, mining engineer, New York, sailed last week for London on professional business. His address will be in care of A. Chester Beatty, 1 London Wall buildings, E. C., London.

Kirby Thomas, mining engineer, 20 Broad street, New York, has returned from a month's examination of nickel properties in the Sudbury district. He will return to Ontario early in September.

C. Vey Holman has retired from the position of State geologist of Maine, the geological survey of that State having been discontinued on July 1 by a law passed at the last session of the legislature.

W. H. Boyd, chief topographer of Canada, is making a special examination and survey of Turtle mountain at Frank, Alberta, to ascertain whether conditions dangerous to the lives of the miners are involved by the reported widening of fissures in the mountain.

George A. Mountain, chief engineer of the Canadian board of railway commissioners, has gone to Yukon territory to examine into the condition of the White Pass & Yukon Railway in connection with the application to the commission for a reduction of freight and passenger rates.

E. M. Rabb, Jr., has resigned his position as chief engineer for the Moctezuma Copper Company at Nacozari, Sonora, and will engage in examination work with headquarters at Denver, Colo. He will be at Johnson, Ariz., for about two months on an examination of the holdings of the Black Prince Copper Company.

J. B. Keiser, vice-president and general manager, and H. S. Geismer, Chattanooga district manager of the Southern Iron and Steel Company since its organization, have tendered their resignations and on Sept. 1 will organize the Keiser-Geismer Engineering Company with offices in Birmingham, Ala., and Chattanooga, Tenn. The firm will devote itself to consulting work covering coal and iron mines, blast furnaces and steel plants in the States of Alabama, Georgia and Tennessee.

## OBITUARY

Lawrence Bartlett, discoverer of the Jenny Lind mine, in Calaveras county, Cal., died on July 20, at San Leandro, Cal., aged 78 years. He went to California in 1848, from New York.

H. K. Develey, one of the owners with Harold T. Power, of the Hidden Treasure and the Mountain Gate mines in Placer county, died at Auburn, Cal., on July 29, aged 79 years. Mr. Develey came to California from Switzerland 57 years ago, and had been continuously engaged in mining. His son, H. K. Develey, Jr., is a statistician employed in the State Mining Bureau.

William A. Hungerford, a prominent mining man of eastern Ontario, died suddenly at Madoc, Hastings county, on Aug. 15. Mr. Hungerford, who was manager of the Canadian Talc and Silica Company's mine at Eldorado, was at the mine when taken ill on Aug. 12. He was conveyed home and, while his condition was considered serious, his sudden death came quite unexpectedly. Mr. Hungerford was born in Ireland in 1847, and came to Canada when 17 years old. He became interested in mining at Madoc during the gold excitement in 1868 and since that time has been associated with many mining enterprises of Hastings county. He leaves a widow and six children.

N. Ramsay Pennypacker, mining engineer, died at Saranac lake, N. Y., on Aug. 20. He was born at "Mount Pleasant," Harford county, Maryland, and was in his 30th year. After receiving a degree of E. M. from Lehigh university, Mr. Pennypacker was for a few years in charge of the operations of the Pennsylvania Feldspar Company in Ontario. In 1907, he went to Nevada for Pennsylvania men, examining a prospect at Rawhide when there were only two tents in the camp. Afterward, he went to Cobalt for Philadelphians and in 1909 was taken ill while planning an expedition to the then new Porcupine gold district; one of the proposed exploring party was Hollinger who later located the Hollinger mine. Mr. Pennypacker was a member of the Delta Phi fraternity. He was a son of Isaac R. Pennypacker and a nephew of ex-Governor Pennypacker, of Pennsylvania.

## SOCIETIES and TECHNICAL SCHOOLS

*Mining and Metallurgical Society*—The first meeting of the New York section for the year 1911-12 will be at the Engineers' Club, New York, Tuesday evening, Sept. 12.

*American Museum of Safety*—A special charter has just been granted the museum by the legislature of the State of New York, thus putting it in the same class with the Metropolitan Museum of Art and the Museum of Natural History. Among the trustees are: E. H. Gary, Philip T. Dodge, James Speyer, Thomas Lynch, Arthur Williams, Edson S. Lott, Frederick L. Hoffman, George F Kunz, Charles Kirchoff, T. C. Martin, Charles A. Doremus, Louis L. Seaman, Frederick R. Hutton, William H. Tolman. The exhibits at the museum include protective devices for the safeguarding of human life in almost every field of labor.

# Editorial Correspondence

**Reports from our own Representatives on Important Events from Many Important Mining Centers of the World**

## San Francisco

*Aug.* 17—The Pacific Gas and Electric Company has under construction a new power line extending from the power station at Electra to Sutter creek. While this line will be an entirely new construction and cause no delay or suspension in the line at present supplying power and light to mines on the Mother Lode, it will, when completed, take the place of the old line. The new line is designed to carry a heavier voltage, required by the increasing demands for power for mining. The particular demands for power are the installation at the South Eureka mine of a 400-h.p. hoist motor, and a 500-h.p. motor at the Argonaut. The work will be completed in two months. The change from the old to the new line will cause only a slight delay of a half day or so in mining operations. All along the Mother Lode there has been an increasing demand for electric power, and this demand has not been confined to the big mines; nor has the demand for electric power for mine operations been confined to this district. The available water supply for the generation of electricity makes possible the application of electric power to mine operations all over the State, in both quartz and dredge mining.

The Independent Producers' Agency is reported to have closed a contract with a representative of the Nicaraguan government for the fuel-oil supply for all public utilities operated by the administration. The initial delivery will be for railway consumption at the rate of 200,000 bbl. per year. Orders for storage tanks have been placed in Los Angeles.

James O'Brien, of Smartsville, has announced through his attorneys that when bidders on Government settling-basin lands come to consider the offer of the Government to receive sealed proposals for purchase of the land they will have him to reckon with. When Mr. O'Brien sold to the Government certain lands for the purpose of constructing a settling basin on Yuba river some 10 miles northeasterly from Marysville, the following reservation clause appeared in the deed dated Dec. 6, 1901: "But reserving and excepting unto the said party of the first part (O'Brien), his heirs and assigns, all precious metals on, or in, said premises, with a right to extract the same, but in a manner not in any wise to interfere with or to undermine or endanger any works constructed by or under the direction of the party of the second part (the Government)." O'Brien was paid $8000 for the land, which, by reason of development and extraction of gold by dredging on adjoining lands, has greatly increased in value. The settling-basin project was abandoned when the dredging companies undertook to build training walls from the tailings of the dredges, and O'Brien offered to repurchase the land at the same price he had received, but the Government declined the offer. The O'Brien land is included with 1818 acres offered in the advertisement of Major S. A. Cheney, United States engineer in charge of the Sacramento and San Joaquin river work, and the offering is a part of several thousand acres along the Yuba acquired by the Government in the work of restraining mining débris, the major portion of which will in time be sold to bidders. In the advertisement for proposals for the 1818 acres Major Cheney calls attention of the bidders to the O'Brien deed and invites attention to the reservations and exceptions contained therein. The lands on which the proposed settling basin was to have been built are in S. 6-T. 15 N.-R. 5 E.-M. D. M., and south of the third standard parallel, between the dredging lands of the Yuba Consolidated Goldfields and the Marysville Dredging Company, and separated from these holdings by the old State dam recently completed by the latter named company. This dam has no economic value since the training wall to the north has been completed, so far as the Government uses are concerned. For power or for irrigation purposes the settling-basin ground could be economically utilized. There is no question as to the value of the land for gold dredging.

## Denver

*Aug.* 18—The story recently circulated in the Cripple Creek district that the necessary money for the completion of the drainage tunnel had been raised and work would commence immediately, is denied by those in authority. It is stated that it will be some time before the subscriptions will be forthcoming, as some of the men who are expected to contribute are not in the State. Until they return there is no hope that the needed funds for driving the tunnel another 1200 ft. into Beacon hill will be raised. The present flow through the portal of the tunnel is about 5800 gal. per min. Of this, 1200 gal. is seepage water and the rest is from the main water body. The recession in the El Paso mine is about two inches per day. An attempt will be made soon to open the well in the bottom of the El Paso shaft, connecting with the Roosevelt tunnel.

Additional samples of ore taken from across the vein opened late last month within 16 miles of Durango by O. M. Kee, a prospector sent into the La Plata mountains by the grubstake committee of the Denver chamber of commerce, have been received by the committee and assayed by the Henry E. Wood Ore Testing Company. The original samples submitted to the committee by Kee assayed 22.36 oz. gold and 26.50 oz. silver, with a value approximating $460 per ton.

It is stated that a custom cyanide plant of 100 tons capacity, to cost $150,000, will be built at Boulder as a result of the second investigation of the mineral resources of Boulder county by President Alderson, of the State School of Mines, and Secretary Wood, of the Boulder Metal Mining Association.

## Salt Lake City

*Aug.* 17—The completion of the Utah Copper Company's railroad, running between Bingham and Garfield, was marked Aug. 13 by the passage of the first passenger train over its lines. Regular trains, however, will not be run until September. The road is 20.6 miles long and was built at a cost of about $3,000,000, or $150,000 per mile, being one of the most expensive lines in the world. It runs through several tunnels, and over three large trestles.

The western part of Bingham was threatened by a brush fire in the early part of the month. The fire started in Markham gulch, and spread to the top of the divide reaching Cottonwood gulch. The buildings of the Bingham Copper and the transformer and compressor house of the old Ben Butler were in danger, but no serious damage was done. The buildings and blacksmith shop of the Mountain Chief were destroyed.

A new resource map has been completed under the supervision of the State Conservation Commission. It is the most complete map of Utah ever issued and shows in detail the amount of surveyed and unsurveyed land, roads, boundary lines, mountains, reserves, mineral deposits, etc. Tables and statistics in regard to towns and cities are printed on the margins. The map will be made the basis of a series of reports in which will be published a large amount of data,

which have been collected in its preparation. In this way much valuable information in regard to the natural and undeveloped resources of the State will be easily obtainable. The map may be had at the office of the commission, 214 Felt building, Salt Lake City, for $5, this price being asked as a help toward payment of the expenses incurred in preparation. It is drawn on a scale of ½ in. to the mile, and is 54x78 in. in size.

July shipments from Park City mines amounted to 9640 tons, the largest tonnage coming from the Daly West, and the next from the Silver King Coalition. The shipments were as follows: Daly West, 3380 tons; Silver King Coalition, 2898; Daly-Judge, 1608; Grasselli Chemical Company, 681; Ontario leasers, 287; Little Bell, 267; C. H. Moore, 20 tons.

## Calumet, Mich.

*Aug.* 18—In a recent hearing at injunction proceedings in connection with the Calumet & Hecla merger case, some interesting data were disclosed relative to the possible worth of the Calumet stamp sands. These data were embodied in an affidavit of the metallurgical engineer for the Calumet & Hecla company. It was stated that these sands may be divided into two classes. One class constitutes 60 per cent., by weight, of the total amount and is known as gravel; this gravel is of such size that it contains the copper within the grains. In the regrinding of the gravel the copper is liberated and 40 per cent. of it is saved. The other class, the remaining 40 per cent. of the total, is in the form of slime in which the copper can be recovered by concentration without regrinding and it is estimated that at least 15 per cent. of the copper contents of these slimes can be recovered. Regarding the carbonization of the copper in the sands it is claimed that two-thirds of the sands are under water and have been from the time they were deposited there as tailings, and that the copper is unaffected. The company expects to recover 137,352,000 lb. of copper at a cost of approximately 6c. per lb., from this source, during the next 30 years.

## Marquette, Mich

*Aug.* 18—At the Twin Falls water power, three miles northwest of Iron Mountain on the Menominee river, the Newton Engineering Company is blasting out a rock flume for the proposed power house of the Peninsula Power Company, which will be situated on a point of land on the Michigan side of the river. There are two falls of 13 ft. each, and about one-half mile apart; the dam is being constructed at the lower fall and will add 16 ft. of head, making a total of 42 ft. The river banks will be flooded for 12 miles up the stream, necessitating the purchasing of considerable land, but the flooded area will provide a desirable storage reservoir. The company, composed of Lake Superior men, has been organized with a capital of $750,000, and O. C. Davidson, general manager of the Oliver Iron Mining Company on the Menominee range, is president. The contract calls for the completion of the dam and power house by Dec. 1 and the machinery to be installed by Feb. 1. The power, of which 2500 h.p. will be generated at first and provision made for 5000 h.p. later, will be sold to mines on the Menominee range. In this connection it is stated that the power plant of the Penn Iron Mining Company, near Vulcan, Mich., recently erected at a cost of $600,000, is planned to pay for itself by the saving in coal in eight years of service. The Peninsula Power Company plans the erection of a steam plant of 1000 h.p. for reserve in times of low water.

Indications are that certain exploratory work on the East Negaunee range will be abandoned by the Corrigan-McKinney company. Under the direction of this company, which holds the lease, work at the Barasa mine has been in progress since last autumn. It is said, however, that developments have not been satisfactory and that the lease is to be surrendered. The present campaign has been conducted entirely with a diamond drill, and while this is still in operation, it will soon be discontinued. When work commenced last autumn, a hoist and a boiler were installed, but this equipment is now being dismantled.

The property is regarded as well situated, as it adjoins the Negaunee mine on the north and the Maas mine on the northwest. Several different times the tract has been under option, and altogether quite an amount of work has been done. The property contains a good shaft, put down at considerable expense, after it was found necessary to abandon the first shaft because of quicksand.

## Toronto

*Aug.* 18—Attention is being drawn to some irregularities in connection with the issuing of leases for coal locations in the West by the Department of the Interior at Ottawa. According to the regulations the rental of $1 per acre must be paid within 30 days from the receipt of the locator's application. Instances are given in which the payment was not made, resulting according to the regulations in the lapsing of the applications. Other locators wishing to secure the claims have found them restaked by the first applicants. This appears to be an easy method of complying with the letter of the regulations, and evading the provision requiring prompt payment of the rental.

W. A. Beddoe, Canadian trade commissioner for New Zealand, reports to the department of trade and commerce that there is a large and increasing demand for cement in that country. The construction work being carried on by the Harbor Board in Auckland consumes 6000 tons of cement per annum. The chairman of the board has signified his willingness to consider proposals from Canada for a supply of 6000 long tons per annum for three years. Under the preferential tariff, Canada has an advantage of 2s. per bbl. of 380 lb. as against foreign competitors. The market for cement now amounts to 100,000 tons per annum, and is rapidly expanding.

## London

*Aug.* 12—Considerable note has been made of the recent decision in New South Wales in the action of Elmore against the Minerals Separation for infringement of patents pertaining to the flotation processes. In fact this decision means nothing so far as the general patent position is concerned. The Minerals Separation defended itself on the ground that the Elmore patents were of no value as they had been anticipated by the Everson patents, and succeeded in knocking Elmore out on this ground. The same ground lies open for anybody else to defend himself against the Minerals Separation. The next action is Potter against Minerals Separation and the defense of the latter in Australia in this case will probably be that the Potter patents were anticipated by the Froment patents, which, in so far as New South Wales is concerned, were public property, as they are in the United States.

There is not much new in London mining, except that a great many mines traded in on the London Stock Exchange are getting very old, and, as usual, they begin to go out in depth, the public in the meantime having capitalized them on their earnings. There is a bad odor every time one of them dies and the result is that the public has lost confidence in the mining business to a great extent. On the other hand, it will probably learn some sense about the method of dealing in mining shares.

The Tanganyika Concessions reported at the end of July that the total amount of copper sent to the railway up to that time was 450 tons. It is said that the furnace is now producing from 12 to 14 tons of copper per day and that the rate of production will gradually be increased to double that quantity. In general the work at the property has been very slow, "owing to necessity of taking precautions for some time to come against mishaps." Nobody seems to have been able to interpret precisely what is the meaning of the last remark. There has been a considerable speculation on the London market in "Tanks" as this company is concisely, if inelegantly, termed. Early in August a rather heavy selling movement of these shares set in, the immediate cause for which has not yet been fully explained.

# The Mining News

**Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining**

## Alaska

*Granville Mining Company*—This holding company is being organized in London and has acquired property in this territory. It is closely affiliated with the Consolidated Gold Fields of South Africa.

*Sulzer*—The mine is making steady shipments and 40 men are employed. Some improvements on surface are contemplated.

*Mother Lode*—An examination of the property by Herman Keller, New York, has been completed. The mine expects to start shipments to the Tacoma smeltery this autumn. A large crew of men is at work under L. A. Lavensaler.

*London Exploration*—This company is developing its copper property on the Kuskulana. A large sum of money has been appropriated for development work and to acquire adjacent properties.

*Beatson*—The mine at Latouche is shipping at the rate of 1000 tons per month. Exploratory work is in progress with diamond drills.

*Barrack*—This property adjoins the Beatson. It has recently been bonded by a syndicate and a crew of men is at work developing.

*Knights Island*—A body of concentrating ore is being developed on this copper property.

*Alaska-Treadwell*—For the month ended July 15, 76,020 tons of ore were crushed, yielding $188,297 gross and net $95,441. Operating expenses were $86,729; construction $64,791. The ore averaged $2.47 per ton. The extraordinary construction expense is due to charging out the machinery bills for the new central hoist and crushers.

*Alaska-Mexican*—For the month ended July 15, 17,806 tons of ore were crushed, yielding $46,627 gross and net $18,805. Operating expenses were $27,356; and $21,620 was charged out against construction of central hoist and crushers.

## Arizona

### Cochise County

*Fluorine Mining and Milling Company*—High-grade gold ore in a vein 6 ft. wide has been cut in a drift now 35 ft. long. The company owns a stamp mill and small cyanide plant for making tests.

*Bisbee Extension*—This company recently acquired the Galvez mines in the Tombstone district.

*Great Western*—Two or three carloads of ore per week are being shipped from this company's mines in the Courtland district, to the El Paso smeltery.

*Rattlesnake*—About 15 lessees are working in this mine, the ore being shipped to El Paso.

### Gila County

*Cole & Goodwin*—This group of 17 claims has been purchased by J. C. Erman, former manager for the Live Oak company. There is a 400-ft. shaft and a 450-ft. crosscut on the property. Under the terms of sale development work was to be started in 15 days.

*Copper Dollar Mining Company*—This company, owning claims south of the Cole & Goodwin group, is preparing to do development work. As soon as the wagon road is completed a shipment of ore will be sent to El Paso.

### Mohave County

*Yucca-Arizona*—This company will sink a shaft at its copper mine, near Franconia. Other development work is also being planned.

*Hercules Mining Company*—This company will install a large pump in its mine. Plans are being made for a mill.

### Pima County

A bond has been given to Colonel Posey by the owners of a tungsten mine in the Guijas district. Development work is to be started at once, and it is thought that the purchase of the property will follow.

*Gold Bullion*—High-grade gold ore has been discovered in the east drift from the Tellurium tunnel.

*Elephant Head*—At this mine, south of Tucson, the number of employees has been doubled within the last month. Sinking and crosscutting work is being done. Silver and copper ore is accumulating on the dump; regular shipments are soon to be made.

*Santa Rita*—These placers, east of Greaterville, are being hydraulicked; 60 men are employed; the water supply is abundant, and is carried to the placer grounds through a flume eight miles long.

### Yavapai County

*Yavapai Metals and Refining Company*—A recent shipment of 40 tons of ore to the smeltery brought $2350 net.

*United Verde*—This company has suspended paying dividends and has curtailed copper production on account of the dilapidated condition of the smeltery, which was built directly over the mine workings. Caving ground has caused much trouble. It is reported that C. H. Repath is preparing plans for a new smeltery.

*Consolidated Arizona Smelting Company*—Judge Lacombe, of the United States Circuit Court, upon the consent of counsel representing all the parties to the litigation, ordered, on Aug. 21, the discontinuance of the suit brought by J. Kearny Rice, trustee in bankruptcy of the Consolidated company, against Joseph R. Delamar, John L. Elliot, Ludwig Vogelstein, George W. Middleton, Charles W. Morse, and John F. Carroll, without costs. The defendants agreed to settle for what they thought to be a reasonable amount and will pay general creditors at the rate of 65 per cent. on each claim, Victor Morawetz and Hooley, Learned & Co. having withdrawn their demands.

## California

### Amador County

*Zeila*—During a temporary shutdown, occasioned by a cave in the north stope at the 1500-ft. level, the reservoir, pipes and mill were overhauled, and the mine put in better working condition.

*Kennedy*—An exceptional cleanup was made for July, said to be the biggest in several years, running approximately $1000 per stamp and totaling about $100,000.

*Amador Queen*—Upon the completion of the new hoist the 1200-ft. shaft will be unwatered and exploration work begun in the west drift.

*Argonaut*—Repair work on the hoisting gear and shaft is in progress. The track and the whole underground workings will be put in order before the mill is started again.

*South Amador*—The boarding house has been refitted for a residence to be occupied by Superintendent McSorley. The shaft is being repaired; the new headframe is about completed.

### Butte County

*Triumph*—A Beer roller mill is being installed and other improvements are being made. N. B. Sears is manager.

*Skipper Gold Mining and Milling Company*—This company is incorporated to mine quartz near Magalia. The directors are Dr. C. L. Browning, L. Mitchell, George F. Kempf, M. J. Harvey and Frank Keller. It is reported that good ore has been discovered.

ELDORADO COUNTY

*Georgia Slide*—New foundations and general reconstruction have been found necessary to the successful operation of the milling plant, which is being thoroughly overhauled.

FRESNO COUNTY

*Delilah*—Tapping of water in this claim, indicating proximity to the vein, is reported. In July the tunnel was driven 55 ft. through hard rock.

*Brushy Ridge*—Favorable reports are made regarding this prospect, which M. Finnegan is developing.

INYO COUNTY

In the Slate range and the north end of the Panamint, especially at Skidoo and Harrisburg, there is unusual mining activity. Large shipments of mining timbers and other supplies are being made.

KERN COUNTY

*King Solomon*—Forty-four tons of ore, milled at the Red Dog, averaged $28 per ton. This ore was mined from the east stope on the 100-ft. level. The Zachery shaft has been deepened to 130 ft., but no pay ore has developed.

*Goler Placer*—A Cuplin pneumatic gold separator is being installed at this mine. R. W. Fairfoull, of Chicago, is manager of the syndicate. P. P. Cuplin, inventor of the machine, is making the installation.

## Colorado

LAKE COUNTY—LEADVILLE

*Hellena*—The retimbering of the shaft is nearly completed. Work will be started at the 700-ft. level to drive to the orebody which was opened on the 500-ft. level.

*Sunday*—Lessees are shipping about 500 tons of lead ore per month.

*Chrysolite*—Shipments of zinc-carbonate ore from the comparatively shallow shaft in which the ore was found are being continued. The finding of ore so near the surface in this shaft has induced other lessees to prospect for the ore closer to the surface.

*Miller Group*—The machinery is all on the ground, and the aërial tramway will be completed before the first snow falls. It is expected that the mine will be operated during the winter.

SAN JUAN REGION

Rich mineral discoveries in the Cow Creek district are reported and are adding considerably to the interest in local mining affairs. Prospectors have been bringing in rich float from the several branches of Cow creek, but the exact place of discovery has not been given out.

*Barstow*—Manager C. R. Wilfley has opened another oreshoot of the type that has made this property famous as a producer in the past. The mill is crushing ore from other parts of the mine.

*Buffalo*—A strike of high-grade ore has been made in this mine, which adjoins the Neglected mine on the east end.

*Corkscrew Gulch*—The owners of claims in Corkscrew gulch are planning to drive a tunnel, starting at some point near the Candes, and cutting the Monas Queen, Carbonate King, Carbonate Queen, Osceola, William Penn, Earle and Electric, Honeycomb and other groups. The tunnel will probably also cut the Sailor Boy workings.

*Cataract*—William Sullivan is doing work on this vein, in which he has found some disseminated sulphide ore containing silver.

*Telluride*—A discovery of platinum ore containing gold has been made in the vicinity of Norwood. The ore is from a bed of sandstone known to be rich in gold, which was located about 30 days ago in a new field in the Naturita cañon, by W. S. and Scott Leach.

SUMMIT COUNTY

*Wellington*—An addition has been made to the mill. The mine and mill are running steadily.

*Reliance*—The dredge is being overhauled and refitted so that it can finish the summer season and, as usual, continue running all winter as well. This is the only one of four dredges in Summit county that is operated during the winter, when the thermometer often falls to 20 or 30 deg. below zero.

*Arctic*—Work at this mine on North Star mountain was started this week, under the supervision of J. L. Moran. The mine is developed by several tunnels. A wire tram connects the mine with the ore platform at the base of the mountain, from which the ore is hauled to the mill. Several machine drills are used in driving the tunnels.

TELLER COUNTY—CRIPPLE CREEK

*Isabella*—From the 14th level of the Lee shaft the contractors have sunk about 100 ft. The 14th level is 1200 ft. down. Sinking is at the rate of 4 ft. per day. The contractors will sink the shaft 500 ft. The mill is operating at full capacity.

*Stratton's Independence*—Philip Argall, general manager of the mine, reports a rich strike made by lessees, who are working on the 300-ft. level at a point about 300 ft. northeast of the main shaft. The strike was made at about the middle of the estate and is in virgin territory.

*Jennie Sample*—This company, operating through the Ophir shaft, has temporarily suspended operations pending a few repairs, but it is expected that work on the oreshoot opened on the 400-ft. level will be resumed in a few days.

*Gold Dollar*—From this mine there were shipped in July 1424 tons of ore, including ore from different lessees in the main shaft and in the Husted shaft.

## Indiana

GIBSON COUNTY

*Gibson*—A 5-ft. vein of coal has been found at this mine. This is a second, or deep vein, and 12 experienced miners are now at work on two shifts, starting the main entries, air course, pumping station, etc. The manway will be sunk to the new vein at once and the capacity of the mine increased as rapidly as possible. The shaft is one of the largest and best constructed in this section of the State.

GREENE COUNTY

*Lattis Creek*—This and the Gilmore mine have been closed. The reason given is that they have recently been purchased by the Monon Coal Company and that the mines cannot be reached by the Monon railroad until a three-mile spur is laid.

*P. & I.*—The mine, three miles south of Jasonville, has been closed and all tools and machinery removed. It is stated that the poor grade of coal caused this action.

*New Boston Hill*—Work has commenced at this mine east of Midland and 300 tons per day are being hoisted. It is the only mine hoisting No. 4 coal in this field.

*Calora*—In a new shaft being sunk at this mine, near Jasonville, No. 3 vein of coal was recently encountered, at a depth of about 155 ft. It is of excellent quality and about 7 ft. thick. The company owns 960 acres of land containing this vein.

## Michigan

COPPER

*Old Colony*—The first drill hole of the present exploratory work, known as No. 7 hole, reached the sandstone without revealing any mineralization. The second hole, going down at a point 650 ft. northwest of the first hole, has cut a copper-bearing lode at a depth of about 165 ft., which is believed to be the extension of the amygdaloid lode that is being opened by the Calumet & Hecla on its St. Louis tract. This hole will continue to the sandstone and then No. 9 hole will be put down vertically to determine the pitch of the lode.

*Hancock*—The No. 2 vertical shaft is sinking below a depth of 2800 ft. on its way to cut the Pewabic lode, which it is calculated will be reached at a depth of about 3500 ft. Developments on No. 3 lode continue to be encouraging. The ore coming from this lode is supplying one head at the Allouez-Centennial mill.

*Franklin*—Parts for the new hoisting equipment for No. 1 Pewabic shaft are being delivered at the property. This equipment is an innovation in hoisting engines. The idea was worked out by R. M. Edwards, general manager, and

utilizes the energy of the descending skip to compress air, which in turn is used to help in hoisting the loaded skip.

*Calumet & Hecla*—At the annual meeting, held on Aug. 16, the old board of directors was reëlected and the sale of the Shelldrake and White Fish Point timber lands was ratified by the stockholders.

*Houghton Copper*—The Superior lode has been reached in the crosscut from the shaft at a depth of 460 ft. The face of the crosscut is breasted in good-looking ore. The crosscut will be extended to the hanging-wall side of the lode and drifting will then be started. The shaft is equipped with an electrical hoisting equipment of sufficient size to meet all requirements.

*Superior*—No. 2 shaft is being equipped with a hoisting engine and compressor that had been in service at the Tamarack Jr. mine.

*Oneco*—The shaft is sinking at a depth of nearly 800 ft. and will continue without any attention to lateral openings until a depth of about 1200 ft. has been reached, the depth at which a heavily-charged drill core was taken. At the 700 ft. level a crosscut was driven into the formation.

## Montana

### Butte District

*Davis-Daly*—As soon as preparations now in progress are completed, shipments will commence from the Colorado mine of this company. M. W. Bacon, general manager, has returned from a consultation with stockholders in New York, and states that the tramway, partially constructed over a year ago for transferring the ore from the Northern Pacific track, will be connected to the railroad at once, and that shipments of about 100 tons of ore per day will be started. Since the examination of the mine by W. M. Wiley, of Los Angeles, some months ago, recommendations made by him with regard to development work have been followed, and on the 1400-ft. and 1700-ft. levels a large amount of ore has been blocked out.

### Deer Lodge County

*Iron Mask*—John Dunn, owner of this mine, three miles from Anaconda, recently struck a well-defined vein, after several years of unsuccessful work. The vein is 3 ft. in width, with good foot and hanging walls.

### Lewis and Clark County

The Marysville district, famous years ago as a rich gold and silver producer, has received fresh impetus since the St. Louis Mining Company recently won its suit over the disputed body of ore lying between the St. Louis ground and the Montana company's Nine-Hour claim. This ore is now being worked by the St. Louis company and treated in the 60-stamp mill of the Montana company.

### Lincoln County

*Kalispell-Lincoln Mining Company*—J. J. Hibbard, of Libby, manager, has arranged to work two shifts of men on the property in the West Fisher gold district, and a stamp mill will be erected as soon as possible. The vein has been stripped in several places for more than 900 ft. along the strike, disclosing an average width of three feet.

### Madison County

*Easton*—At this mine, near Virginia City, a force of 60 men is employed in mining and developing. Between 25 and 30 tons of ore per day are being mined and treated at the mill. Air for the drills has been supplied from the compressor plant at the Pacific mine, but the company is about to build a small compressor plant at the mine and will abandon the old plant. Recently a new body of ore was opened, which has considerably increased the output.

*Bell*—George Madine and George Duich, who are leasing this mine, lately encountered a shoot of high-grade ore from which a shipment of 16 tons was made to the Washoe smeltery. The mine contains considerable low-grade milling ore, well adapted to cyanide treatment and negotiations are now under way for the purchase of the property, the intention being to erect a mill should the deal be consummated.

*Nellie Bly*—This and the St. John claims near Butcher gulch are being operated by Butte men, and several adjoining claims have been taken up recently by them. It is planned to form a company and to erect a mill and work the property on a large scale.

## Nevada

### Comstock Lode

*Mexican*—According to the monthly financial statement of the company filed at the San Francisco office, there was a balance of $52,419 in the treasury on Aug. 1, out of which was paid a dividend of 10c. per share, amounting to $20,160. The balance will be applied to the construction of the new mill and to current expenses. Net returns of ore shipments for August amounted to $14,450, with settlement pending on several cars. The work of sinking the new winze on the 2500 level has been started.

*Crown Point*—The stope on the 1400 level produced 285 mine cars of ore of a gross assay value of $2721. The assays show richer ore as the stope is carried up. During the week ended Aug. 12, the Yellow Jacket mill crushed 1230 tons of ore from the dumps.

*Chollar-Potosi*—Shipments of ore from the lease on the croppings of these two properties are averaging 200 tons per day, giving a production of $10,000 per week.

*Ophir*—Sill-floor sets were placed last week on the 2200 level, preparatory to stoping, the Hardy vein having been opened for a long distance in the north drift. The company shipped a railroad car of concentrates during the week ended Aug. 12, and bullion, as a result of a cleanup made at the Kinkead mill on 2000 tons of ore.

### Esmeralda County

*Atlanta*—The Queen Consolidated Leasing Company has resumed drifting and crosscutting on the 700-ft. level of its lease on this property. A drift is being driven northwest to one of the spurs of the St. Ives vein.

*Queen Consolidated*—On the Maloney lease a crosscut on the 650-ft. level is still being driven. Two veins have been cut, but the gold content is small; the work will not be stopped to explore these veins.

*Goldfield Consolidated*—The work being done at the Jumbo shaft is nearly finished. A hoist was recently placed in position; the shaft has been repaired; the drifts have been cleaned. Ore bins are being built at the side of the Consolidated tracks so that the ore can be loaded direct into the steel cars for transportation to the mill. Tracks from the shaft to the bins and waste dumps are being laid.

*Goldfield Reduction Company*—At the inclined shaft on the Great Bend ore is being stoped from two levels. The ore is being treated at the reduction plant at Goldfield. This shaft was recently equipped with an electric hoist. A new electric hoist has been installed at the Toplitz shaft on the west end of the Daisy. A drift will be driven on the 100-ft. level to a shaft sunk by H. A. Morrison about midway between the Toplitz and Golden Daisy shafts.

*Florence*—The new equipment installed to supplant the concentrators and vanners has perceptibly increased the capacity of the mill; 180 tons per day is now being treated. It is said that the recovery by amalgamation and cyanidation is improved. The shaft, which is now 850 ft. deep, will be further deepened before cutting a station on the 800 level.

### Nye County

*Tonopah Mining Company*—The repairs to the Desert Queen shaft are about completed. Mining will soon be resumed in that part of the company's property wherein there is much virgin ground.

*Montana-Tonopah*—A new vein has been cut on the 565-ft. level; it is only a few inches wide where first cut, but as it is being drifted upon it is found to be wider.

*McNamara*—Excavation work on the site for the 10-stamp mill has been started. All the machinery has been ordered. It is expected that by Nov. 15 the mill will be ready for operating.

## New Mexico

### GRANT COUNTY

*Chino*—Stripping operations are being continued. Preparations for mining have reached a point where shipments to the mill can be started as soon as the latter is ready. Plans for the proposed enlargement of the mill, at Hurley, have been completed.

### SOCORRO COUNTY

*Tri-Bullion*—Shaft sinking is being continued, and a station is being cut on the 200-ft. level. Both mills are running night and day.

*Graphic*—A shaft is sinking on the west contact deposit. A car of ore was recently shipped for sampling and experimental purposes.

*Juanita*—Four cars of high-grade lead- and zinc-carbonate ores were shipped last month. Shipments for the present month will be increased.

*Socorro*—The company has ordered two engines of 250 h.p. each and an auxiliary engine of 180 h.p. These engines will have to be transported over 90 miles of wagon road.

*Treasure*—Sixty tons of ore per day are being mined and hauled to the mill. Bids are being received for the installation of a wire-rope tramway to connect the mine and mill.

*Deadwood*—The mill is treating about 80 tons per day, which is 20 tons more than the estimated capacity. The crude-oil engine is giving satisfactory results.

*Ernestine*—The cleanup for the first 10 days in July amounted to 6213 troy oz. of silver. The mill is treating about 700 tons per week.

### VALENCIA COUNTY

What is believed to be an asphaltum deposit has been discovered by Amado Chavez, in the Zuni mountains of the San Mateo region, near the border line of McKinley county. The deposit is several hundred yards in extent, is covered with a thin layer of dirt, and was discovered through the fact that it renders the ground shaky and elastic. Samples are now being analyzed. It is said that a pole 30 ft. long failed to find bottom when driven into the deposit.

## Oregon

### BAKER COUNTY

*Gorman*—This group of claims has been leased to W. H. Turner, J. C. Haas and others, of Sumpter, who will increase the working force at once.

### CLACKAMAS COUNTY

*Molalla*—A seam of coal three feet thick has been found on a farm near this post office. Work has been started on the seam.

### DOUGLAS COUNTY

*West Coast*—At this company's mill, 10 out of 30 stamps are in operation, crushing 26 tons of ore per day from the Champion mine.

### JOSEPHINE COUNTY

*Swastika*—This mine has been closed for the season, and extensive repairs will be made. A. C. Howland, Grant's Pass, is manager.

*Steam Beer*—This placer property is being equipped with machinery for reduction of the tailings. H. K. Miller, Grant's Pass, is in charge.

### LANE COUNTY

*Oregon Mines Corporation*—Operations on these properties will commence soon on a large scale. The company has recently purchased the stamp mill of the Crystal Consolidated group.

## South Dakota

### BLACK HILLS DISTRICT

*Osterman-Danckwardt*—Oct. 1 has been set as the date for blowing in this smeltery at Galena. Work is progressing rapidly.

*Gilt Edge Maid*—The concentrator, which is being built adjoining the smeltery, is nearing completion, and will be ready about Sept. 15.

## Utah

### BEAVER COUNTY

*Lady Bryan*—The shaft is down 400 ft., and four teams are hauling ore, which is taken out in development only.

*White Rock*—A 25-ton car of ore brought $1350. The ore, which contains lead and silver, was opened in a drift and raise from the 100-ft. level. A drift to the east is 120 ft. from the bottom of the shaft, and is being sent out for the contact of blue limestone, which is mineralized on the surface.

*Michigan*—The country rock at this property is white and gray limestone and granite, which are cut by several fissures. The inclined shaft has followed a fissure in the granite down 200 ft. A drift from the bottom shows lead ore of concentrating grade.

*Beaver Gold Mining*—This company owns 10 claims covering the north and south extensions of the Sheep Rock mine, north of Beaver City. The shaft, started half a mile north of the point where the Sheep Rock is mining, will be sunk 100 ft., and crosscutting started for the vein.

### JUAB COUNTY

*Dragon Consolidated*—Work on iron ore has been suspended and shipments stopped. It is reported that the smelting contract has expired.

*May Day*—Twelve blocks of ground are being worked by leasers, and a body of lead ore of shipping grade has been opened. A new contract for shipping the low-grade ore direct to the smelteries is being arranged for.

*North Scranton*—The tunnel is reported to have passed through caves similar to those in the Scranton, which it adjoins on the north.

*Carisa*—Ore is being taken out in development.

*Opohongo and Gold Chain*—Work at these properties has been suspended for a few weeks, while the jointly owned machinery is being installed.

*Tintic Central*—Work has been suspended here. An official of the company states that new equipment will have to be purchased before work can be resumed.

*Utah Consolidated*—It is stated by officers of the company that the character of the rock in the fissure 200 ft. below the tunnel is improving. The fissure is being followed to the east, and an upraise is being driven in mineralized rock, carrying chiefly copper, with gold, silver and iron. Owing to an accident to the tram line, ore is being shipped by railroad to the Tooele smeltery.

### PIUTE COUNTY

*Gold Mountain Consolidated*—This property is now owned by L. L. Nunn, general manager of the Telluride Power Company, for whom Frank J. Gustin, as trustee, purchased the equity of redemption. Among the assets are two hydro-electric plants and one steam plant. The mining property is being examined with a view to resuming operations.

### SALT LAKE COUNTY

*Cardiff*—Work on the new tunnel will be started within 10 days. This tunnel will be 2500 ft. long to connect with former workings. Ore is being marketed at the rate of 100 tons per month.

*Montana-Bingham*—A contract for driving a tunnel 4000 ft. through Bingham Amalgamated ground has been signed. This will open the Bingham Amalgamated 500 ft. below the old Copper Glance tunnel. The consideration is 125,000 shares of Amalgamated treasury stock.

*Utah Mines Coalition*—A recent shipment of 100 tons of ore brought $37 net per ton. The tonnage is being increased. Five teams are hauling ore.

*Alta Consolidated*—Leasers are extracting ore from an outcropping fissure. Drifting is being done in the old tunnel. Excavating for the foundations of the compressor plant is in progress.

*Woodlawn*—The two tunnels on this property are being repaired and preparations made for resuming work. A winze has been sunk in ore.

### SUMMIT COUNTY

*Daly-Judge*—During July, 750 ft. of development work were done. All levels from the 700 to the 2300 are being developed. The Ontario drain tunnel, which will tap the ground at the 2500-ft. level, is approaching the end lines. In July,

4000 tons of ore were mined, of which 1600 tons, including zinc ores, were shipped direct to the smelteries.

*American Flag*—This property is being operated by the American Exploration Company. Development is being done south of the fault, where sulphides have been found above the 1100 level. This places the work well above the water level, and does away with water difficulties.

*Ontario*—Leasers are taking out from 15 to 20 tons of ore per day. There are 25 men at work.

*Western Monitor*—Preparations for development are being made at this property in Thaynes cañon.

## Washington

### Chelan County

*Horseshoe Basin*—This company has let a contract for driving a tunnel on this property near Chelan. A large force of men will be put to work at once.

### Ferry County

*Butte & Boston*—Some fine ore has been encountered on this property in the Republic camp, and plans are being made for considerable development work.

### Okanogan County

*Rebecca Gold*—The tunnel on this property is to be extended, and other development work done. T. E. Clark, Nespelem, has charge.

*Kimberley*—This property is being developed by S. A. DeMerchant, of Oroville, who expects to make some shipments soon.

## Wisconsin

### Zinc-Lead District

*American Zinc Ore Separating Company*—Huff electrostatic machines have increased the capacity to 100 tons of concentrates per day.

*Campbell*—This company, at Cuba City, has added sufficient equipment to increase its output to 50 tons of concentrates per day.

*Wisconsin*—A double-cylinder magnetic separator and roaster has been completed by this company at Benton.

*Mineral Point Zinc Company*—This company has taken over the Coon Branch mine at Benton and the Rajah mine at Linden, the fee having been purchased some time ago.

*Coker*—The mill equipment, owned and operated by the Mineral Point Zinc Company at Livingston was totally destroyed by fire recently. It will be rebuilt.

*Enterprise*—The mine will be reopened by the New Enterprise Mining Company, which is a reorganization of the Platteville Lead and Zinc Company. The mine is one of the oldest in the district.

*Trego*—The Monarch Mining Company has reopened this mine formerly operated by the Big Four Mining Company.

## Canada

### Ontario

*Penniac*—At this mine, situated on Star lake just across the Manitoba border in the Lake-of-the-Woods area, visible gold has been found at the bottom of the shaft 76 ft. deep. High-grade ore has been exposed by stripping on the surface.

*St. Anthony*—At this property in the Sturgeon Lake area, an offshoot of the main vein traced into the shaft for 20 ft. at the 100-ft. level has widened from 18 in. to 3½ feet.

*Gould*—Ore carrying native silver has been struck in shaft No. 2 at this Cobalt mine. Development work will be pushed with a large force.

*Gleason*—On this property at Cobalt, about one-half mile west of Gillies station, which has been prospected extensively for some time without important results, wire silver has been found in a smaltite vein at a depth of about 45 feet.

*Crown Reserve*—The vein supposed to be an extension of the Hollinger main vein running into this Porcupine property has been opened by trenching and shows 12 ft. of quartz and schist carrying free gold.

*Preston-East Dome*—Superintendent Thorne has submitted a report on the property at Porcupine, in which the total loss due to the recent fire is given as $15,240.

*North Dome*—A new vein showing free gold was uncovered by blasting on these Porcupine claims at a point about 280 ft. northeast from the old shaft and 40 ft. south from the new shaft. With more work the vein widened to six feet.

## Mexico

### Chihuahua

*Chihuahua Mining Company*—High-grade ore was recently discovered in the El Potosi mine in the Santa Eulalia district. It is reported that from 14 test holes sunk, ore 38 ft. wide is indicated.

*Mina Princesa*—A gasolene hoist has just been installed and shaft sinking will be started at once. Two cars of ore are being shipped daily to El Paso. W. J. Wallace, Cusihuiriachic, is manager.

*El Tajo*—At this property, which has been idle for several months, operations are to be resumed.

*Apodaqueña*—The installation of new pumps and electric machinery in the mine has been completed. It is said that the pumps cost $30,000 and that $40,000 has been spent so far in improvements.

### Hidalgo

*Encino y Anexas*—From 20 to 30 tons of ore are being sent daily to the La Luz hacienda at Pachuca.

*Real del Monte y Pachuca*—The Loreto mill is treating 700 tons of ore per day. The principal sources of supply are the Barron and Camelia veins. The Camelia ore is delivered through the Girault tunnel by electric-motor trains; the Barron ores are delivered by an aërial tram.

### Jalisco

*Tajo*—The mill is now equipped with 20 stamps, two tube mills, concentrators and cyanide plant. Experiments are being made in cyaniding concentrates.

### Mexico

*Esperanza*—During July, 20,503 tons of ore yielded $135,140 at a cost of about $101,540. For construction work, $6609 was spent and $913 was received from rents and other sources.

### Morelos

*La Cuauhtemoc Mining and Smelting Company*—This company is incorporated with a capitalization of $3,000,000. Development work is being done at the lead-silver mines and a contract has been let for building a small smeltery.

### San Luis Potosi

*Tiro General*—The A. S. & R. Co. has purchased this group of mines near Los Charcos for 1,600,000 pesos. The Tiro General ore contains about 2½ per cent. copper, 200 to 400 grams silver, 1 to 4 grams gold, 11 to 14 per cent. zinc and some lead. The mines have been steadily shipping a large tonnage of ore to the Aguascalientes smeltery for eight or nine years. The ore is needed at the smeltery for the copper it contains and it has generally been understood that the former owners sold their ore under a very favorable contract.

### Sonora

Minitas is the name of a new gold-field about 30 miles west of Alamos. Three mines are being operated, La Prieta, La Junta and Zorra Negra. At the Junta and Prieta mines five-stamp mills have been built. The ore is free milling, and so far has averaged one ounce gold per ton.

*Mina Mexico*—The smeltery is closed and will not be operated until the close of the rainy season. Burros have been used to bring in supplies, but auto trucks are to be tried. There are 500 burros packing supplies and the eight tons of coke required daily for the furnaces.

*Dominion Syndicate*—This company has again taken charge of the mines that were, until recently, operated by the Mexican Metals Company. The Metals company is still operating the Arizpe mines, which property includes 50,000 acres of land.

## Asia

### Chosen

*Oriental*—During June 28,537 tons of ore were crushed, yielding $103,987 gross and net $25,814. Operating expenses were $69,907; development, $9165.

# The Markets

## Coal Trade Review

*New York, Aug.* 23—The trade in Western soft coal is still dull, but somewhat firmer, owing to the curtailment in the output of lump coal; the output of screenings is automatically decreased and prices are a little steadier, but no important rise is likely, as any current demands can be quickly supplied. In the East, there is little activity in either anthracite or bituminous.

Much interest is being taken in the complaint of the Bituminous Coal Operators of Central Pennsylvania against the Pennsylvania Railroad, before the Interstate Commerce Commission. This alleges unjust discrimination against the coals of the Latrobe subdistrict, which, it is claimed, should be classed in the Greensburg district and not in the Clearfield, and also claims that the rate from the Clearfield district to South Amboy, N. J., is unduly high.

The Norfolk & Western and Baltimore & Ohio report car shortages, which seems strange in view of the general dull market, but this is said to be due to troubles at the Lake ports in unloading, and consequent car congestion there. The Pennsylvania, Lehigh Valley, Philadelphia & Reading, and Lackawanna report no car troubles, but some dealers say that the cars take a little overtime in getting through, and that a sudden demand would see a few days' shortage.

### Coal Traffic Notes

Anthracite shipments on the Pennsylvania lines east of Pittsburg in July were 781,854 short tons, an increase of 158,604 tons over July, 1910, and an increase of 426,743 tons for the first seven months of this year. Bituminous shipments in July were 3,414,146 tons, and coke shipments 815,599 tons, the latter being a decrease of 192,671 tons for the month and of 2,214,805 tons for the first seven months of this year.

## New York

### Anthracite

*Aug.* 23—Practically no trade is being done by small buyers, and all the coal which is moving is on contract. The textile mills have not yet evinced any activity. Price cutting is less in evidence than is usual at this season, and what is done is on the poorer qualities of coal.

### Bituminous

The season is still dull, although Pocahontas operators report matters as looking a little brighter. There is no change in the price schedules, though some concessions would doubtless be made on large orders placed before the autumn business starts.

## Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

## Birmingham

*Aug.* 21—More men are at work in the mines and the work is steadier now than at any time this year. The demand for coal shows some improvement. It is given out that during the coming month there will be need for a much larger output and the railroads have been notified that more cars will be necessary with which to handle the output. The coal prices show no change.

While many miners have left the district during the dull spell it is apparent that a majority of those who formerly worked in this State are returning or waiting the word to return. Some of the retail dealers are now laying in winter stock. The larger consumers, the railroads and other big interests, will hardly begin receiving their winter coal until after this month. Many contracts are in hand which will require coal from the mines in this State into next year.

The demand for coke is better and the ovens in shape are being operated on full time. The consumption of coke is steady.

## Chicago

*Aug.* 21—The market continues quiet, but with steam sizes of Western coals in lessened supply, so that prices are a little firmer. Buying of domestic coals, while fairly normal for the time of the year, has not met the expectation of dealers who looked for an early start, and probably it will not be active before cool weather comes.

For steam uses the demand is good and slowly increasing. Miners of Western coals, because of their nearness to the market and their large productive capacity, are quick to take advantage of any slight turn in the market; they ship their product in plentifully on any indication of scarcity or increased demand. They act so closely on the ups and downs of the market as to cause consumers to become wary of buying on transient reports.

For special uses, such as harvesting, sales are large; for domestic uses they are smaller. No coal is in such short supply that an increased demand for it cannot be quickly supplied.

Illinois and Indiana bring in general on cars $1.90@2.35 for lump, $1.70@1.80 for run-of-mine and $1.45@1.60 for screenings. Smokeless is plentiful as to run-of-mine and scarce as to lump, the former selling at $3@3.15 and the latter at $3.80@4.20. Hocking is quiet, with shipments kept down to hold the market steady at $3.15. Anthracite continues dull, with little prospect of a revival soon.

## Indianapolis

*Aug.* 21—The Indiana coal operators are in a quandary as to the real situation in the coal-mining business. After over a week of good orders that put several thousand of the miners to work, the buying at the mines almost ceased and the last week proved dull.

A few weeks of cool weather, the operators think, will start a good domestic demand. The winter needs of the retailer must be stored soon and cool weather is a reminder of this.

The manufacturers are buying more freely, indicating an improvement in this line of business. Notwithstanding the bottom has dropped out of the demand in this State, the operators are sanguine that the autumn and winter business will be of satisfactory volume.

## Pittsburg

*Aug.* 22—The local coal situation shows no change. Manufacturing and domestic demand is light. Lake shipments are fairly heavy. A few mines are running practically at full capacity, while others are not doing better than 50 to 60 per cent. Prices are fairly well maintained. We continue to quote: nut, $1.10@1.15; mine-run, $1.15; ¾-in., $1.25; 1¼-in., $1.35; slack, 60@75c. per ton at mine.

*Connellsville Coke*—Prompt furnace coke has become scarcer, there having been not a car of demurrage coke in the region for several days, while only limited lots can be picked up at $1.55, the minimum price quoted on regular lots last week. The slack has all been taken up by larger consumption by steel-works furnaces, merchant-furnace consumption being unchanged since a number of furnaces went out. Several contracts for furnace coke for the balance of the year have been under negotiation, but are no nearer closing than a week ago. The scarcity of labor has become pronounced, some operations being actually handicapped to a slight degree, while it is difficult to obtain men to fork box cars, always an undesirable job in summer. We quote: Prompt furnace, $1.55@1.60; contracts over balance of year, $1.65@1.75; prompt foundry, $1.85@2; contract foundry, $2@2.25.

The *Courier* reports production in the Connellsville and lower Connellsville re-

gion in the week ended Aug. 12, at 304,-044 tons, an increase of 13,000 tons, and shipments at 3453 cars to Pittsburg, 4575 cars to points west and 820 cars to points east, a total of 8848 cars, an increase of 140 cars. A steady increase in coke production has been reported since the second week in June, when production was stated at 266,646 tons and shipments at 8347 cars.

### St. Louis

*Aug.* 19—The market for the last week has been slow as dealers seem to have stopped buying almost entirely on account of the hot weather which, of course, made it impossible to advance the price of lump. On the other hand it seemed impossible to check the declining tendency of screenings in spite of the fact that coal is netting the operators less at the mine than it has at any time this year, and they are sustaining heavy losses on every pound of coal they produce under present market conditions.

The present condition in lump and screenings has been brought about by some operators selling ahead on lump coal, and others anticipating a declining market have sold considerably ahead on screenings. Those selling ahead on lump are forced to dispose of their screenings at whatever they will bring and those who sold ahead on screenings are forced to dispose of lump at the present unsatisfactory market price, and as a consequence each makes it impossible for the other to advance the price on the other sizes.

Needless to say that those who have nothing to sell ahead have closed down their pits temporarily. A couple of weeks' time will be all that is necessary to clean the situation up as the orders on hand will be pretty well filled by that time and operators will cease to tread on each others' toes.

Carterville operators report business much better. Screenings remain stationary at about $0.50, with lump and egg and nut firmer.

Standard coal is now quoted at $1.57 for 6-in. lump; $1.37 for 2-in.; $1.27 for run-of-mine; $1.37 for 2-in. nut; $0.87 for 2-in. screenings, f.o.b. St. Louis. Other bituminous prices remain unchanged.

Anthracite is picking up and demand seems to be better for all sizes. Chestnut in particular is beginning to move freely.

## FOREIGN·COAL·TRADE

*Welsh Coal Prices*—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on Aug. 12, as follows: Best Welsh steam coal, $4.56; seconds, $4.20; thirds, $3.96; best dry coals, $4.04; best Monmouthshire, $3.84; seconds, $3.69; best small steam coal, $2.64; seconds, $2.04. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

## IRON·TRADE·REVIEW

*New York, Aug.* 23—The market last week witnessed a fair amount of small-lot buying, but prices have not stiffened, concessions having been given in most instances. The short-time buying that has been in progress for several months is keeping consumers in the market with fair regularity, but orders for future delivery continue to be scarce.

The independent steel mills are operating between 70 and 75 per cent. of capacity, and the Steel Corporation at between 75 and 80 per cent. of capacity. These percentages refer to the proportion of capacity in operation, not to actual tonnage output. The latter is naturally light in hot weather, so that in point of actual tonnage the industry is producing nearer two-thirds than three-fourths of its full normal capacity.

Production has been increasing since the beginning of the month, by reason of large bookings late in July and early this month, but this has not stiffened the backbone of the market. Mills are as ready as ever to cut prices to obtain specifications for immediate rolling, and the market has degenerated into open competition for prompt business, with buyers completely frightened off from buying for forward delivery. A favorable feature arising from this condition, however, is that production is closely regulated to actual consumption, and yet is fairly heavy, so that should consumption increase, or should buyers become ready to increase their stocks, now known to be at bottom, a satisfactory tonnage would inevitably result.

### Baltimore

*Aug.* 21—Imports for the week included 28,690 tons of iron ore from Cuba.

### Birmingham

*Aug.* 21—Southern pig-iron manufacturers are receiving inquiries for iron to be delivered in 1912, but, as far as can be learned, there have been but few sales made. The manufacturers are not inclined to sell at the prevailing prices, and hence are abstaining from making any general quotation for next year. Some selling of iron is still going on for delivery during the last quarter of the year, the price being stated at $10.50 per ton, No. 2 foundry. There is little iron being sold now at $10 per ton. The books of the majority of the companies are pretty well supplied with business for several weeks to come, and there is a healthy delivery.

Basic iron is being handled in quantity, steel plants in the Southern territory, as well as elsewhere, calling for this kind of iron. Charcoal iron sells at $22.50 per ton, and the demand is not much under the make. Steel rails are in especially good demand, while fabricated steel is being shipped from this district as rapidly as it is being manufactured.

### Chicago

*Aug.* 21—There is improvement in the pig-iron market, due to increased activity and more hopeful prospects for the foundries, though individual sales continue to be of the small sort, with here and there a venturesome buyer who goes over the 500-ton mark or is willing to contract for his needs of the first quarter. The average melter is content to stick to buying for the last quarter yet, and he needs considerable iron because of general short-time buying for several months past.

Southern iron is variable in price, some sales being made at perhaps $10.25, Birmingham, or $14.60, Chicago, though $10.50 is being asked by the furnace agents generally, and $11 for deliveries more than three months hence. Northern No. 2 foundry brings $14.25@14.75, with business quiet.

In the finished market there is little change; sales of most iron and steel products are good, with structural material quiet, but a number of important contracts pending and railroad supplies in very good demand. Coke is quiet at $4.60 for the best Connellsville.

### Pittsburg

*Aug.* 22—Iron and steel trade conditions this week are less satisfactory than last week. The previous improvement does not seem to have carried the trade very far, considering how serious an impression a fortnight of unsatisfactory business has made. There have been fairly large bookings in spots in the last week, but the total tonnage has been quite unsatisfactory, and prices have shown a slight further weakness, not so much in having declined as in having failed to stiffen when the mills are known to be operating on much better schedules than formerly.

Cut prices are made on practically all products but rails. The cutting, however, is not deep, but proceeds by small fractions of a dollar. Bars are done at 1.20c. against the nominal price of 1.25c. and plates at 1.30c. against a nominal figure of 1.35c. The 1.35c. on structural shapes is fairly well maintained. Sheets continue to be freely shaded, $1 in practically all territory and $1 more in Ohio and Chicago territory.

*Pig Iron*—The Standard Sanitary Manufacturing Company late last week bought the iron for which it was inquiring, taking about 7000 tons for fourth-quarter delivery, at $14.15 delivered to its Allegheny plant and $14.05 delivered to its New Brighton plant, for No. 2 foundry, with 25c. less for No. 3 and 15c. under No. 3 for gray forge.

The New Brighton iron came from Valleys, with 55c. freight, making the furnace price the regular market, $13.50, while the Allegheny iron came from nearby furnaces, having less than the Valley freight. The delivered price was 25c. under the price which would be made with $13.50, Valley, and the size of the cut is presumably explained by competition between the nearby furnaces.

Odd lots of foundry iron are being taken for early delivery at the regular figures. Basic and bessemer iron have been very quiet. We continue to quote at Valley furnaces: Bessemer, $15; basic, $13@13.25; No. 2 foundry, $13.50; gray forge, $13; malleable, $13.25@13.50. Prices delivered Pittsburg are 90c. higher, but foundry can be done at $14.25, Pittsburg, from furnaces nearer than the Valleys.

*Ferromanganese*—The regular sellers continue to quote $37, Baltimore, for prompt or forward delivery, and will make delivery at least through the first half of next year at this figure. A Sharon steel interest has bought 400 tons for first half at this figure. Small lots for prompt shipment can generally be picked up at $36.50, Baltimore. Freight to Pittsburg is $1.95 per ton.

*Steel*—Reports that sheet bars have been sold at $2 under the regular figure cannot be confirmed. Sales of both billets and sheet bars appear to have been light, but deliveries on regular contracts are fully as large as in July. We quote billets at $21 and sheet bars at $22, f.o.b. maker's mill, Pittsburg or Youngstown, with rods at $27, Pittsburg.

*Sheets*—The market has not improved at all as to volume of business, and the shading is somewhat more extended. While the extreme does not pass $2 per ton, such a concession is given over wider territory, while over the rest of the country $1 per ton continues to be done regularly. Subject to shading of $1@2 per ton, according to situation and specifications, we quote regular prices as follows: Black, 28-gage, 2c.; galvanized, 3c.; blue annealed, 1.50c.; painted corrugated, $1.40 per square; galvanized, $2.55 per square.

## Philadelphia

*Aug.* 23—Liberal orders have been placed for basic pig and pipe iron during the last few days. One or two large concerns are negotiating for deliveries from three to six months hence. Quotations made on recent inquiries show that competition is sharp. Contrary to predictions made by local makers, Southern irons are still finding their way into Northern territory, but it is explained that the orders are merely completions of former negotiations. The only difference in prices now and a month ago is that the makers of first-class brands are getting their price without shading, and that they are being offered contracts for delivery in some cases up to the close of the year. The market has not gained as much as was expected. Consumers refuse to accept the theory that a gradual hardening of prices is at hand. If conditions were as they usually are, a large amount of iron would be contracted for at this time and makers say that the dullness and weakness are mainly due to the persistent hand-to-mouth policy of buying. Average quotations for No. 1X foundry, $15; gray forge, $14.25, and basic shaded from $15 per ton.

*Steel Billets*—Several long delayed contracts have been placed for billets, though the quantities purchased are about half the amount named in inquiries. Notwithstanding the improved outlook, quotations on rolling and forging billets have been shaded, which probably accounts for the recent business.

*Pipes and Tubes*—Little new business has been definitely closed, but manufacturers report some inviting inquiries.

*Steel Rails*—A fair week's business has been done in steel rails for Southern roads and for the Pacific lines, besides round lots for Mexico and Japan.

*Scrap*—Scrap dealers accepted the opportunity presented within a week of unloading considerable scrap at good prices. The lower grades are still cheap and plentiful.

## St. Louis

*Aug.* 19—The pig-iron market remains about the same though it seems to be just a shade better than last week. The volume of business is fair but the buying is mostly in small lots at price of $10@10.25 per ton, f.o.b. Birmingham, or $13.75@14 per ton, f.o.b. St. Louis.

# FOREIGN IRON TRADE

## United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for the six months ended June 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

| | 1910 | 1911 | Changes |
|---|---|---|---|
| Exports | $96,411,485 | $125,874,551 | I.$29,463,066 |
| Imports | 20,629,503 | 16,026,005 | D. 4,603,498 |
| Excess, exp. | $75,781,982 | $109,848,546 | I.$34,066,564 |

Increase in exports, 30.6 per cent.; decrease in imports, 22.3 per cent. The leading items of exports and imports were, in long tons:

| | Exports | | Imports | |
|---|---|---|---|---|
| | 1910 | 1911 | 1910 | 1911 |
| Pig iron | 41,709 | 66,914 | 118,053 | 79,067 |
| Scrap | 11,839 | 45,088 | 10,005 | 33,991 |
| Billets, blooms, etc. | 7,531 | 109,644 | 11,425 | 24,821 |
| Bars | 57,445 | 78,074 | 21,910 | 11,691 |
| Rails | 129,437 | 228,877 | .... | .... |
| Sheets and plates | 157,140 | 182,809 | 3,771 | 1,143 |
| Structural steel | 75,014 | 134,378 | ..... | ..... |
| Wire-rods | 13,601 | 8,499 | 9,086 | 8,519 |
| Wire | 82,719 | 107,165 | ..... | ..... |
| Nails and spikes | 25,608 | 39,757 | ..... | ..... |
| Tinplates | 6,685 | 25,619 | 36,224 | 12,127 |
| Pipe and fittings | 74,108 | 98,887 | ..... | ..... |

Imports of wire not reported in quantities; the values were $758,068 in 1910, and $710,970 in 1911. Imports of rails and structural steel not reported separatey. Exports of mining machinery were valued at $3,033,280 in 1910, and $3,467,692 this year.

# METAL MARKETS

*New York, Aug.* 23—There has been a little more activity in copper and in lead, but in spelter there has been nothing doing, owing to the peculiar situation in that metal. All things considered, the metal markets have been holding very well indeed in the face of the disturbance in some other lines of business.

## Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

| Metal | Exports | Imports | Excess |
|---|---|---|---|
| Gold: | | | |
| July 1911 | $2,178,088 | $ 2,594,653 | Imp.$ 416,565 |
| " 1910 | 828,451 | 10,282,649 | Imp. 9,354,198 |
| Year 1911 | 15,429,650 | 36,367,679 | Imp. 20,938,029 |
| " 1910 | 50,345,182 | 29,671,180 | Exp. 20,674,002 |
| Silver: | | | |
| July 1911 | 5,275,008 | 3,920,794 | Exp. 1,354,214 |
| " 1910 | 5,124,471 | 3,794,888 | Exp. 1,480,120 |
| Year 1911 | 39,718,211 | 25,881,395 | Exp. 13,836,816 |
| " 1910 | 32,178,689 | 25,696,408 | Exp. 6,482,281 |

Exports from the port of New York, week ended Aug. 19: Gold, $5000; silver, $576.213 to London and Paris. Imports: Gold, $591,185, mainly from Mexico; silver, $725,122, from South America and Japan.

*Platinum*—The market is firm with prices higher. Dealers ask $45 for refined platinum and $47.50 for hard metal. The foreign market continues strong at the advanced price.

*Iridium*—This metal continues steady at $62 per ounce.

*Silver*—The market has been firm with advancing tendency, caused by buying of the Indian Bazaars. Market closes steady at 24⅛d. in London, with probability of fluctuations within narrow limits.

SILVER AND STERLING EXCHANGE

| Aug. | 17 | 18 | 19 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|
| New York | 52 | 52 | 52⅛ | 52⅛ | 52⅛ | 52⅛ |
| London | 24 | 24 | 24 1/16 | 24⅛ | 24⅛ | 24⅛ |
| Sterling Ex. | 4.8600 | 4.8605 | 4.8605 | 4.8605 | 4.8605 | 4.8600 |

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, from Jan. 1 to Aug. 10, reported by Messrs. Pixley & Abell:

| | 1910 | 1911 | Changes |
|---|---|---|---|
| India | £3,842,100 | £5,038,100 | I. £1,196,000 |
| China | 1,113,500 | 890,400 | D. 223,100 |
| Total | £4,955,600 | £5,928,500 | I. £972,900 |

*Copper*—The market has shown surprising resisting power in the face of the unsettled financial market. A good business in electrolytic has taken place during the week, both for home trade and for export, the buying for foreign account constituting the larger proportion of the transactions. About all the agencies are offering at 12⅝c., usual terms, but about

all the business actually transacted has been at concessions of 2½ to 7½ points. Lake copper is readily available at 12⅝c., though some small sales of special brands as high as 12.80c. are reported. The close is steady at 12½@12¾c. for Lake copper and 12.40@12.45c. for electrolytic, in cakes, wirebars and ingots. Casting copper is quoted nominally at 12@12¼ cents.

## Copper, Tin, Lead and Zinc

NEW YORK

| Aug. | Copper | | Tin | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|
| | Lake, Cts. per lb. | Electrolytic, Cts. per lb. | Cts. per lb. | New York, Cts. per lb. | St. Louis, Cts. per lb. | New York, Cts. per lb. | St. Louis, Cts. per lb. |
| 17 | 12¼ @12¾ | 12.40 @12.45 | 45½ | 4.50 | 4.37½ @4.40 | 6.00 @6.10 | 5.85 @5.95 |
| 18 | 12½ @12¾ | 12.40 @12.45 | 46 | 4.50 | 4.37½ @4.40 | 6.00 @6.10 | 5.85 @5.95 |
| 19 | 12½ @12¾ | 12.40 @12.45 | 46 | 4.50 | 4.37½ @4.40 | 6.00 @6.10 | 5.85 @5.95 |
| 21 | 12½ @12¾ | 12.40 @12.45 | 46 | 4.50 | 4.37½ @4.40 | 6.00 @6.05 | 5.85 @5.90 |
| 22 | 12½ @12¾ | 12.40 @12.45 | 44½ | 4.50 | 4.37½ @4.40 | 6.00 @6.05 | 5.85 @5.90 |
| 23 | 12¼ @12¾ | 12.40 @12.45 | 44 | 4.50 | 4.37½ @4.40 | 6.00 @6.05 | 5.85 @5.90 |

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

| Aug. | Copper | | | Tin | | Lead, Spanish | Zinc, Ordinaries |
|---|---|---|---|---|---|---|---|
| | Spot | 3 Mos | Best Sel'td | Spot | 3 Mos | | |
| 17 | 56¼ | 57 | 60½ | 190⅜ | 187⅜ | 14 | 27¼ |
| 18 | 56¼ | 57 | 60½ | 191 | 188 | 14 | 27¼ |
| 19 | ..... | ..... | ..... | ..... | ..... | .... | .... |
| 21 | 56⅛ | 57⅛ | 60⅜ | 191 | 188½ | 14 | 27¾ |
| 21 | 56¼ | 57 | 60½ | 190½ | 187¾ | 14⅛ | 27¾ |
| 23 | 56¼ | 57 | 60½ | 189¼ | 186¾ | 14⅛ | 27¾ |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± ± £1 = 0.21¾c.

The standard market in London has, so to speak, not moved throughout the week, the close being steady at £56 5s. for spot, and £57 for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill.

Exports of copper from New York for the week were 8971 long tons. Our special correspondent gives the exports from Baltimore for the week at 2247 tons.

*Tin*—The London market of the past week did not present any special features. It remained steady to firm with only slight variations in the quotations. The close is cabled at £189 5s. for spot, and £186 15s. for three months.

The domestic market seems to be absolutely bare of spot tin, at least so far as dealers are concerned. The enormous premium which is being asked and has been paid for small lots of spot material, amounting to about 4c. per pound, has undoubtedly led to the inhibition of a great many melting operations in which tin is required. There are at present no shipments in sight from London and the few lots that are *en route* to this port are owned by consumers, so that they will not alleviate the very unsatisfactory spot situation. No interest is shown by consumers in future deliveries. Spot tin is quoted at between 44½c. and 45c., while August delivery may be nominally called 44 cents.

*Lead*—There has been but little change in the position of this metal. The St. Louis market is gradually assuming its natural relation to the price ruling at Eastern centers. The market closes steady at 4½c., New York, and 4⅜@4.40c., St. Louis.

The foreign market has been exceedingly firm. It is reported that due to a general increase in consumption, available supplies of lead have been reduced to a lower point than for several years past. The close is firm at £14 2s. 6d. for Spanish lead, and £14 5s. for English.

*Spelter*—Smelters are well sold out for nearby shipment, and as no metal is in the hands of speculators, it stands to reason that consumers, in turn, have supplied their current requirements. Occasionally some consumer comes into the market and pays a premium for a carload or so of spelter for immediate delivery, but this is retail business. So far there appears to be no desire on the part of consumers to anticipate their requirements for future shipment at the present level of prices. In consequence, actual business is in very small volume, and the market is quoted more or less nominally at 5.85@5.90c., St. Louis, and 6@6.05c., New York.

The London quotation has again advanced £1 during the week, but in spite of the higher prices the demand for spelter in the European market has not abated. There is a severe shortage of supplies for delivery during this year, and on account of a strained labor situation there is no likelihood of an increased supply for some time to come. Unfortunately there are no stocks of spelter in this country with which the European demand could be satisfied to an appreciable extent. The close is cabled as strong at £27 15s. for good ordinaries, and £28 for specials.

Zinc dust is quoted at 7½c. per lb., f.o.b. New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

## Other Metals

*Aluminum*—There have been few transactions during the week, and the price for No. 1 ingots remains unchanged at 19¼@20c. per lb., f.o.b. New York.

*Antimony*—The market shows but little life, with prices shaded slightly. Cookson's is quoted at 8.37½@8.50c. per lb.; Hallett's at 7.75@8c. per lb.; Chinese, Hungarian and other outside brands, 7.25@7.50c. per pound.

*Quicksilver*—This metal has been in fair demand with prices steady at $48 per flask of 75 lb., with advances for small lots. San Francisco quotes $47@47.50 for domestic and $44.50@45 for export orders. London quotations remain unchanged at £9 per flask, with £8 17s. 6d. asked for second hands.

*Bismuth*—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

*Cadmium*—The last quotation was 700@725 marks per 100 kg.—75.5@78.3c. per lb.—at works in Germany, according to quantity.

*Magnesium*—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

## Zinc and Lead Ore Markets

*Platteville, Wis., Aug.* 19—The base price paid this week for 60 per cent. zinc ore was $43@44 per ton. The base price for 80 per cent. lead ore was $57 per ton. One lot of 600 tons brought $60 per ton.

SHIPMENTS, WEEK ENDED AUG. 19

| Camps | Zinc ore, lb. | Lead ore, lb. | Sulphur ore, lb. |
|---|---|---|---|
| Platteville | 774,090 | ..... | 503,780 |
| Mineral Point | 569,650 | ..... | ..... |
| Hazel Green | 240,000 | ..... | ..... |
| Benton | 160,800 | 81,400 | ..... |
| Cuba City | 87,480 | ..... | 69,940 |
| Galena | 85,100 | ..... | ..... |
| Harker | 79,380 | ..... | ..... |
| Rewey | 61,000 | ..... | ..... |
| Monfort | 60,000 | ..... | ..... |
| Highland | 56,400 | ..... | ..... |
| Shullsburg | ..... | 119,600 | ..... |
| Linden | ..... | 40,390 | 112,520 |
| Total | 2,173,900 | 241,390 | 686,240 |
| Year to date | 97,357,979 | 5,401,625 | 20,213,190 |

There was shipped during the week to separating plants 1,414,420 lb. of zinc ore.

*Joplin, Mo., Aug.* 19—The highest price for zinc-sulphide ore last week was $48 per ton, the base ranging from $40@45 per ton of 60 per cent. zinc. Zinc silicate sold on a base of $21@23 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $41.18 per ton. The highest price for lead ore was $63 per

ton, with the market easier at the week-end. The average price, all grades of lead, was $60.40 per ton.

Several hundred tons of blende have been held for a base price higher than $45, but the purchasing agent stood firm. Producers fail to realize that while open-market quotations are as high as $6 per hundred, East St. Louis, a large portion of the spelter shipments are on contracts no higher than $5.70, with advance offerings for spelter all under $6.

The district is fast recovering from the recent inflow of water, and will be back to a normal production early in September. The smelting situation in Kansas is again normal, the strike being at an end, with the smelteries running almost at full capacity. Most of the smelters have sufficient ore stocks to enable them to withstand any effort on the part of producers to force an unreasonable price for ore.

MONTHLY AVERAGE PRICES

| Month | Zinc Ore: Base Price | | Zinc Ore: All Ores | | Lead Ore: All Ores | |
|---|---|---|---|---|---|---|
| | 1910 | 1911 | 1910 | 1911 | 1910 | 1911 |
| January | $47.31 | $41.85 | $45.16 | $40.55 | $56.99 | $55.68 |
| February | 40.69 | 40.21 | 39.47 | 39.16 | 53.64 | 54.46 |
| March | 43.60 | 39.85 | 39.71 | 38.45 | 51.26 | 54.57 |
| April | 41.00 | 38.88 | 39.33 | 37.47 | 49.72 | 56.37 |
| May | 40.19 | 38.25 | 37.51 | 36.79 | 48.16 | 55.21 |
| June | 40.20 | 40.50 | 37.83 | 38.18 | 48.80 | 56.49 |
| July | 39.63 | 40.75 | 36.80 | 38.36 | 48.59 | 58.81 |
| August | 40.13 | ..... | 37.32 | ..... | 49.75 | ..... |
| September | 43.45 | ..... | 39.96 | ..... | 54.73 | ..... |
| October | 43.31 | ..... | 40.50 | ..... | 53.18 | ..... |
| November | 47.20 | ..... | 43.20 | ..... | 54.80 | ..... |
| December | 42.50 | ..... | 40.70 | ..... | 55.70 | ..... |
| Year | $42.43 | ..... | $39.79 | ..... | $52.12 | ..... |

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

SHIPMENTS, WEEK ENDED AUG. 19

| | Blende | Calamine | Lead Ore | Value |
|---|---|---|---|---|
| Webb City-Carterville | 3,111,460 | ..... | 1,246,400 | $103,355 |
| Joplin | 2,181,900 | ..... | 280,120 | 54,283 |
| Duenweg | 622,720 | 110,690 | 62,190 | 16,101 |
| Alba-Neck | 728,080 | ..... | ..... | 16,017 |
| Galena | 337,680 | ..... | 101,650 | 10,191 |
| Jackson | 465,070 | ..... | ..... | 9,766 |
| Miami | 181,650 | ..... | 86 500 | 5,724 |
| Spurgeon | 135,000 | 63,210 | 25,160 | 4,223 |
| Granby | ..... | 205,990 | 22,640 | 3,400 |
| Sarcoxie | 122,460 | ..... | ..... | 2,571 |
| Lawton | 121,820 | ..... | ..... | 2,558 |
| Cave Springs | 64,350 | ..... | 19,610 | 2,177 |
| Aurora | 65,000 | 62,690 | ..... | 2,056 |
| Quapaw | 80,920 | ..... | ..... | 1,537 |
| Carl Junction | 64,390 | ..... | ..... | 1,481 |
| Oronogo | 76,550 | ..... | ..... | 1,325 |
| Badger | 7,540 | ..... | 21,700 | 1,021 |
| Totals | 8,366,590 | 442,580 | 1,865,970 | $237,788 |
| 33 weeks | 319,268,780 | 21,618,630 | 56,240,600 | $8,129,331 |
| Blende val., the week, $175,887; 33 weeks, | | | | $6,286,540 |
| Calamine, the week, 5,540; 33 weeks, | | | | 252,654 |
| Lead value, the week, 56,361; 33 weeks, | | | | $1,590,137 |

## CHEMICALS

*New York, Aug.* 23—The general market remains dull, though in several lines sales are reported to be increasing.

*Arsenic*—The white-arsenic market is a little firmer, with spot lots at $2 per 100 lb.; futures, $1.75 per 100 lb. A stronger tone has been given to the market by inquiries from insecticide manufacturers, who are beginning to cover 1912 requirements.

*Copper Sulphate*—There have been few transactions during the last week, and prices are unchanged at $4.50 per 100 lb. for carload lots and $4.75 for smaller parcels.

*Nitrate of Soda*—The market is quiet but prices remain firm. Quotations are 2.15c. per lb. for spot nitrate; 2.17½c. per lb. for deliveries through the remainder of 1911; and 2.20c. for 1912 deliveries.

## MINING·STOCKS $

*New York, Aug.* 23—The week on the Stock Exchange was marked by a still further average decline in prices, although individual stocks showed a rally. The general street gossip is still distinctly pessimistic in tone, and the 50 per cent. recovery which usually follows a decided slump is not looked for. The Houston Oil reorganization plan is reported to be more favorable to the common stockholders than was expected, in that a 10 per cent. sacrifice of stock, or a payment of a 50c. assessment, is all that will be required.

On the Curb, Giroux at 4¾, Kerr Lake at 4½, La Rose at 3¾ and United Copper at 1½, all made new low records, and in no case was the close of the week over ⅛ point higher. Standard Oil also hit bottom for the year at 595. Nipissing was weak, closing at 8, while British Columbia Copper sold off to 3⅞. It is explained that the dividend on the last is not passed but merely deferred until the settlement of the British Columbia coal strike, which has cost the company $25,000 per month extra for coke, but the market did not react on this announcement.

*Boston, Aug.* 22—Copper stocks got quite a shaking up last week and new low prices for the year were recorded in many cases. The nervous state of the market was accentuated by the financial difficulties of N. L. Amster, who has been sponsor and president of the Shannon, Arizona Commercial and Boston & Corbin companies.

These stocks all had severe breaks and a serious condition was avoided by leading brokers who took over Mr. Amster's holdings in brokers' offices and in the banks. Meantime Arizona Commercial broke from $12.25 to $2 and the 6 per cent. convertible bonds tumbled from 50 per cent. to 36 per cent. with subsequent recovery to 45. Boston & Corbin fell from $10.25 to $3.87½ and Shannon from $9.75 to $7.25. Recoveries from these low prices have followed in the cases of Boston & Corbin and Shannon.

The Arizona Commercial is facing a reorganization as its treasury is bare and mining is being done at a loss. An issue of Boston & Corbin convertible bonds has been underwritten and Shannon is earning money on the stock. The recent slump in the New York market has caused a lot of forced liquidation in copper shares and the market is bare of buying orders. Calumet & Arizona broke $5 to a low at $46, and Calumet & Hecla went down to $400 flat.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

| Company | May | June | July |
|---|---|---|---|
| Alaska shipments | 3,092,000 | ..... | ..... |
| Anaconda | 22,100,000 | 21,850,000 | 21,900,000 |
| Arizona, Ltd | 2,800,000 | 2,700,000 | 2,750,000 |
| Balaklala | 978,426 | ..... | ..... |
| Copper Queen | 7,140,196 | 7,088,862 | 6,373,062 |
| Calumet & Ariz | 3,854,000 | 3,656,000 | 4,394,000 |
| Detroit | 1,709,530 | 1,732,692 | 1,590,357 |
| East Butte | 1,135,000 | 841,200 | ..... |
| Mammoth | ..... | ..... | 1,598,082 |
| Nevada Con | 5,277,355 | 5,307,400 | 5,258,582 |
| Old Dominion | 2,363,000 | 1,907,000 | 2,114,000 |
| Shannon | 1,229,760 | 1,098,000 | 1,150,000 |
| South Utah | 318,350 | 158,661 | 254,462 |
| United Verde* | 3,000,000 | 3,000,000 | 3,000,000 |
| Utah Copper Co | 8,391,879 | 7,908,685 | 7,555,407 |
| Lake Superior* | 19,000,000 | 19,800,000 | ..... |
| Non-rep. mines* | 10,188,000 | 14,625,000 | ..... |
| Total production | 92,577,496 | 91,673,500 | ..... |
| Imports, bars, etc. | 19,481,190 | 22,348,964 | ..... |
| Total blister | 112,058,686 | 114,922,464 | ..... |
| Imp. in ore & matte | 6,801,365 | 4,744,912 | ..... |
| Total | 118,860,051 | 119,767,376 | ..... |
| Brit. Col. Cos.: | | | |
| British Col. Copper | 976,121 | ..... | ..... |
| Granby | 1,238,328 | ..... | ..... |
| Mexican Cos.: | | | |
| Boleo | 2,411,500 | 2,315,040 | 1,973,680 |
| Cananea | 4,098,000 | 3,462,000 | 3,994,000 |
| Moctezuma | 2,403,583 | 2,071,960 | 2,340,404 |
| Other Foreign: | | | |
| Cape Cop., S. Africa | 1,001,280 | ..... | ..... |
| Spassky, Russia | 586,880 | 542,080 | ..... |
| Exports from: | | | |
| Chile | 7,392,000 | 3,960,000 | 7,168,000 |
| Australia | 11,088,000 | 7,168,000 | 7,056,000 |

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

| Month. | United States Product'n. | Deliveries, Domestic. | Deliveries for Export |
|---|---|---|---|
| VII, 1910 | 118,370,003 | 56,708,175 | 59,407,167 |
| VIII | 127,803,618 | 67,731,271 | 61,831,780 |
| IX | 119,519,983 | 64,501,018 | 75,106,496 |
| X | 126,469,284 | 67,814,172 | 68,186,912 |
| XI | 119,353,463 | 60,801,992 | 67,424 316 |
| XII | 123,339,219 | 43,594,018 | 88,104,075 |
| Year 1910 | 1,452,122,120 | 749,426,542 | 722,431,494 |
| I, 1911 | 115,696,591 | 42,078,567 | 53,208,739 |
| II | 109,828,297 | 50,518,998 | 45,111,019 |
| III | 130,532,080 | 66,080,789 | 59,081,127 |
| IV | 118,085,223 | 52,407,650 | 62,129,599 |
| V | 126,962,544 | 64,543,963 | 61,978,557 |
| VI | 124,554,312 | 61,655,561 | 71,460,519 |
| VII | 112,167,934 | 56,982,582 | 74,880,658 |

VISIBLE STOCKS.

| | United States. | Europe. | Total. |
|---|---|---|---|
| VIII, 1910 | 170,640,678 | 222,320,000 | 392,960,675 |
| IX | 168,881,245 | 218,444,800 | 387,326,046 |
| X | 148,793,714 | 211,276,800 | 360,070,519 |
| XI | 139,261,914 | 198,060,800 | 337,322,711 |
| XII | 130,389,069 | 193,200,000 | 323,589,095 |
| I, 1911 | 122,030,195 | 236,629,120 | 358,649,373 |
| II | 142,439,490 | 236,992,000 | 379,431,134 |
| III | 156,637,779 | 233,385,600 | 390,023,009 |
| IV | 162,007,934 | 223,014,400 | 385,022,434 |
| V | 165,555,908 | 212,284,800 | 377,840,708 |
| VI | 165,995,932 | 202,540,800 | 368,536,732 |
| VII | 157,434,164 | 195,932,800 | 353,366,964 |
| VIII | 137,738,858 | 191,891,840 | 329,630,698 |

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe

The Curb market was more or less affected by the general weakness, although considerable trading was done in Rhode Island Coal which put the price up from $1 11/16 to $3 per share. Davis-Daly also shows improvement in its market price.

### Assessments

| Company | Delinq | Sale | Amt |
|---|---|---|---|
| Belcher, Nev | July 31 | Aug. 21 | $0.10 |
| Bonanza Mountain, Ida | Aug. 15 | Sept. 9 | 0.001 |
| Bullion, Nev | Aug. 3 | Aug. 25 | 0.05 |
| Calumet, Ida | Aug. 15 | Sept. 15 | 0.001 |
| Cedar Creek, Ida | Aug. 9 | Sept. 9 | 0.003 |
| Challenge, Nev | Aug. 17 | Sept. 7 | 0.05 |
| Con. Virginia, Nev. | Sept. 9 | Sept. 13 | 0.25 |
| Copper King, Ida | Aug. 15 | Sept. 16 | 0.01 |
| Dalmatia, Ida | Aug. 3 | Sept. 4 | 0.10 |
| Douglas, Ltd., Ida | Aug. 25 | Sept. 26 | 0.002 |
| Hale & Norcross, Nev | Aug. 30 | Sept. 20 | 0.05 |
| Ida. Copper, Ida | Aug. 10 | Sept. 1 | 0.003 |
| Melcher, Ida | Aug. 26 | Sept. 15 | 0.001½ |
| New York-Bonanza, Utah | Sept. 8 | ..... | 0.02 |
| Pretoria, Ida | Aug. 15 | Sept. 15 | 0.000½ |
| Savage, Nev | Aug. 22 | Sept. 12 | 0.10 |
| Seven Troughs Mon., Utah | Aug. 12 | Sept. 6 | 0.002½ |
| Spider, Utah | Aug. 15 | Sept. 15 | 0.002½ |
| Tintic Standard, Utah | Sept. 9 | Oct. 9 | 0.00 |
| Torino, Ida | Aug. 15 | Sept. 15 | 0.00 |
| Utah Ideal, Utah | Sept. 6 | Oct. 8 | 0.001½ |
| Utah United Copper, Utah | June 24 | ..... | 0.01½ |
| Verde May, Ida | Sept. 6 | Sept. 21 | 0.000½ |
| Victoria, Mich | Aug. 21 | ..... | 1.00 |
| Wabash, Utah | Aug. 12 | Sept. 2 | 0.10 |
| Yankee Con., Utah | Aug. 18 | Sept. 4 | 0.01 |

### Monthly Average Prices of Metals

SILVER

| Month | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1909. | 1910. | 1911. | 1909. | 1910. | 1911. |
| January | 51.750 | 52.375 | 53.795 | 23.843 | 24.154 | 24.865 |
| February | 51.472 | 51.534 | 52.222 | 23.706 | 23.794 | 24.081 |
| March | 50.468 | 51.454 | 52.745 | 23.227 | 23.690 | 24.324 |
| April | 51.428 | 53.221 | 53.325 | 23.708 | 24.483 | 24.595 |
| May | 52.905 | 53.870 | 53.308 | 24.343 | 24.797 | 24.583 |
| June | 52.538 | 53.462 | 53.043 | 24.166 | 24.651 | 24.486 |
| July | 51.043 | 54.150 | 52.630 | 23.519 | 25.034 | 24.286 |
| August | 51.125 | 52.912 | ..... | 23.588 | 24.428 | ..... |
| September | 51.440 | 53.295 | ..... | 23.743 | 24.567 | ..... |
| October | 50.923 | 55.490 | ..... | 23.502 | 25.596 | ..... |
| November | 50.703 | 55.635 | ..... | 23.351 | 25.680 | ..... |
| December | 52.226 | 54.428 | ..... | 24.030 | 25.160 | ..... |
| Total | 51.502 | 53.486 | ..... | 23.706 | 24.670 | ..... |

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

| | New York | | | | London, Standard | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Lake | | | |
| | 1910. | 1911. | 1910. | 1911. | 1910. | 1911. |
| January | 13.620 | 12.295 | 13.870 | 12.680 | 60.923 | 55.604 |
| February | 13.332 | 12.256 | 13.719 | 12.611 | 59.388 | 54.970 |
| March | 13.255 | 12.139 | 13.586 | 12.447 | 59.214 | 54.704 |
| April | 12.733 | 12.019 | 13.091 | 12.275 | 57.238 | 54.035 |
| May | 12.550 | 11.989 | 12.885 | 12.214 | 56.313 | 54.313 |
| June | 12.404 | 12.385 | 12.798 | 12.611 | 55.310 | 56.368 |
| July | 12.215 | 12.463 | 12.570 | 12.720 | 54.194 | 56.670 |
| August | 12.490 | ..... | 12.715 | ..... | 55.733 | ..... |
| September | 12.379 | ..... | 12.668 | ..... | 55.207 | ..... |
| October | 12.553 | ..... | 12.788 | ..... | 56.722 | ..... |
| November | 12.742 | ..... | 12.914 | ..... | 57.634 | ..... |
| December | 12.581 | ..... | 12.863 | ..... | 56.769 | ..... |
| Year | 12.738 | ..... | 13.039 | ..... | 57.054 | ..... |

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

| Month | 1910. | 1911. | Month | 1910. | 1911. |
|---|---|---|---|---|---|
| January | 32.700 | 41.255 | July | 32.695 | 42.400 |
| February | 32.920 | 41.614 | August | 33.972 | ..... |
| March | 32.463 | 40.157 | September | 34.982 | ..... |
| April | 32.976 | 42.185 | October | 36.190 | ..... |
| May | 33.125 | 43.115 | November | 36.547 | ..... |
| June | 32.769 | 44.606 | December | 38.199 | ..... |
| | | | Av. Year | 34.123 | ..... |

Prices are in cents per pound.

LEAD

| Mohth | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1910. | 1911. | 1910. | 1911. | 1910. | 1911. |
| January | 4.700 | 4.483 | 4.582 | 4.334 | 13.650 | 13.009 |
| February | 4.613 | 4.440 | 4.445 | 4.266 | 13.328 | 13.043 |
| March | 4.459 | 4.394 | 4.307 | 4.238 | 13.063 | 13.122 |
| April | 4.376 | 4.412 | 4.225 | 4.262 | 12.641 | 12.889 |
| May | 4.315 | 4.373 | 4.164 | 4.223 | 12.550 | 12.984 |
| June | 4.343 | 4.435 | 4.207 | 4.292 | 12.688 | 13.260 |
| July | 4.404 | 4.499 | 4.291 | 4.397 | 12.531 | 13.530 |
| August | 4.400 | ..... | 4.290 | ..... | 12.513 | ..... |
| September | 4.400 | ..... | 4.289 | ..... | 12.582 | ..... |
| October | 4.400 | ..... | 4.271 | ..... | 13.091 | ..... |
| November | 4.442 | ..... | 4.314 | ..... | 13.217 | ..... |
| December | 4.500 | ..... | 4.363 | ..... | 13.197 | ..... |
| Year | 4.446 | ..... | 4.312 | ..... | 12.920 | ..... |

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

| Month | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1910. | 1911. | 1910. | 1911. | 1910. | 1911. |
| January | 6.101 | 5.452 | 5.951 | 5.302 | 23.350 | 23.887 |
| February | 5.569 | 5.518 | 5.419 | 5.368 | 23.188 | 23.276 |
| March | 5.637 | 5.563 | 5.487 | 5.413 | 23.031 | 23.016 |
| April | 5.439 | 5.399 | 5.289 | 5.249 | 22.469 | 23.743 |
| May | 5.191 | 5.348 | 5.041 | 5.198 | 22.100 | 24.375 |
| June | 5.128 | 5.520 | 4.978 | 5.370 | 22.094 | 24.612 |
| July | 5.152 | 5.695 | 5.002 | 5.545 | 22.406 | 25.006 |
| August | 5.279 | ..... | 5.129 | ..... | 22.800 | ..... |
| September | 5.514 | ..... | 5.364 | ..... | 23.165 | ..... |
| October | 5.628 | ..... | 5.478 | ..... | 23.900 | ..... |
| November | 5.976 | ..... | 5.826 | ..... | 24.083 | ..... |
| December | 5.624 | ..... | 5.474 | ..... | 24.019 | ..... |
| Year | 5.520 | ..... | 5.370 | ..... | 23.050 | ..... |

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

| | Bessemer | | Basic | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1910 | 1911 | 1910 | 1911 | 1910 | 1911 |
| January | $19.90 | $15.90 | $17.98 | $14.40 | $17.94 | $14.75 |
| February | 18.96 | 15.90 | 17.21 | 14.50 | 17.38 | 14.81 |
| March | 18.53 | 15.90 | 16.93 | 14.65 | 17.00 | 14.96 |
| April | 18.28 | 15.90 | 16.84 | 14.65 | 16.75 | 15.00 |
| May | 17.10 | 15.90 | 15.94 | 14.30 | 16.18 | 14.72 |
| June | 16.52 | 15.90 | 15.60 | 14.06 | 15.53 | 14.56 |
| July | 16.40 | 15.90 | 15.40 | 14.03 | 15.40 | 14.53 |
| August | 16.09 | ..... | 14.89 | ..... | 15.16 | ..... |
| September | 15.92 | ..... | 14.73 | ..... | 14.93 | ..... |
| October | 15.90 | ..... | 14.05 | ..... | 14.88 | ..... |
| November | 15.84 | ..... | 14.26 | ..... | 14.78 | ..... |
| December | 15.90 | ..... | 14.15 | ..... | 14.65 | ..... |
| Year | $17.10 | ..... | $15.65 | ..... | $15.83 | ..... |

## STOCK QUOTATIONS

COLO. SPRINGS Aug. 22

| Name of Comp. | Bid. |
|---|---|
| Acacia | ‡.03 |
| Cripple Cr'k Con. | .01⅞ |
| C. K. & N. | .10½ |
| Doctor Jack Pot | .05½ |
| Elkton Con | .57½ |
| El Paso | .50½ |
| Findlay | .04½ |
| Gold Dollar | .15½ |
| Gold Sovereign | .02 |
| Isabella | .09⅞ |
| Jack Pot | .06 |
| Jennie Sample | .08 |
| Lexington | .01 |
| Moon Anchor | .02½ |
| Old Gold | .03 |
| Mary McKinney | .36 |
| Pharmacist | ‡.01½ |
| Portland | .97 |
| Vindicator | .74 |
| Work | .01 |

SALT LAKE Aug. 22

| Name of Comp. | Bid. |
|---|---|
| Beck Tunnel | .16½ |
| Black Jack | .10 |
| Carisa | .15 |
| Cedar Talisman | .03½ |
| Colorado Mining | .42 |
| Columbus Con | .30 |
| Daly Judge | ‡4.12½ |
| Grand Central | .99 |
| Iron Blossom | 1.05 |
| Little Bell | .40 |
| Lower Mammoth | .02½ |
| Mason Valley | 7.25 |
| May Day | .12 |
| Nevada Hills | 3.45 |
| New York | ‡.05 |
| Prince Con | .68 |
| Silver King Coal'n | 1.65 |
| Sioux Con | .30 |
| Uncle Sam | .46½ |
| Yankee | ‡.15 |

TORONTO Aug. 22

| Name of Comp. | Bid | Name of Comp. | Bid |
|---|---|---|---|
| Coniagas | 6.50 | Pearl Lake | .40½ |
| Hudson Bay | ‡.75 | Porcu. Gold | .47½ |
| Temiskaming | .39½ | Porcu. Tisdale | ‡.05½ |
| Wettlaufer-Lor | .86 | Preston E. D | .29½ |
| Apex | .12 | West Dome | 1.90 |
| Central | .75 | Standard | .04½ |
| Dobie | ‡1.00 | Canada | 1.00 |
| Dome Exten | .64½ | Rea | 3.15 |
| Hollinger | 10.00 | Coronation | .14 |
| Imperial | .08 | Swastika | .44½ |

SAN FRANCISCO Aug. 22

| Name of Comp. | Clg. | Name of Comp. | Bid |
|---|---|---|---|
| COMSTOCK STOCKS | | MISC. NEV. & CAL. | |
| Alta | .05 | Belmont | 6.45 |
| Belcher | .45 | Jim Butler | .26 |
| Best & Belcher | .15 | MacNamara | .18 |
| Caledonia | .48 | Midway | .18 |
| Challenge Con | .16 | Mont.-Tonopah | .69 |
| Chollar | .12 | North Star | .12 |
| Confidence | ‡.56 | West End Con | .58 |
| Con. Virginia | .83 | Atlanta | .16 |
| Crown Point | .46 | Booth | .09 |
| Gould & Curry | 12 | C.O.D. Con | .09 |
| Hale & Norcross | .15 | Comb. Frac | .08 |
| Mexican | 4.02½ | Jumbo Extension | .19 |
| Occidental | .60 | Oro | .06 |
| Ophir | 1.70 | Silver Pick | .06 |
| Overman | .36 | St. Ives | .32 |
| Potosi | .17 | Tramps Con | .02 |
| Savage | .20 | Argonaut | 2.25 |
| Sierra Nevada | .47 | Bunker Hill | ‡7.00 |
| Union Con | 1.50 | Cent. Eureka | 1.00 |
| Yellow Jacket | .37 | So. Eureka | ‡7.00 |

N. Y. EXCH. Aug. 22

| Name of Comp. | Clg. |
|---|---|
| Amalgamated | 61 |
| Am. Agri. Chem | 53 |
| Am.Sm.&Ref.,com | 71 |
| Am. Sm.& Ref., pf. | 105 |
| Anaconda | 36¼ |
| Batopilas Min | 1½ |
| Bethlehem Steel pf | 60 |
| Chino | 19⅛ |
| Comstock Tunnel | .20 |
| Federal M.& S., pf. | 50 |
| Goldfield Con | 5⅝ |
| Great Nor., ore ctf. | 47¼ |
| Homestake | 82¾ |
| Miami Copper | 19¾ |
| Nat'nal Lead,com. | 56 |
| National Lead, pf. | 104 |
| Nev. Consol | 17⅜ |
| Pittsburg Coal, pf. | 18¾ |
| Ray Con | 14¾ |
| Republic I&S.com | 26 |
| Republic I & S, pf. | 91¾ |
| SlossSheffi'd,com. | 42 |
| Sloss Sheffield, pf. | 112 |
| Tennessee Copper | 31½ |
| Utah Copper | 44½ |
| U. S. Steel, com | 72⅞ |
| U. S. Steel, pf | 115¾ |
| Va. Car. Chem | 54⅞ |

N. Y. CURB Aug. 22

| Name of Comp. | Clg. |
|---|---|
| Barnes King | ‡.15 |
| Braden Copper | 4⅞ |
| B. C. Copper | 3⅞ |
| Buffalo Mines | 1¾ |
| Butte & Vipond | .53 |
| Butte Coalition | 15⅜ |
| Calumet & Mont. | ‡.20 |
| Cobalt Central | .01 |
| Con. Ariz Sm | 1⅛ |
| Davis-Daly | 1⅝ |
| Ely Con | 7/16 |
| Florence | 1⅞ |
| Giroux | 4⅞ |
| Greene Cananea | 6⅛ |
| Greenwater | .05 |
| Guanajuato | ‡33¾ |
| Guerrero | ‡1⅛ |
| Guggen. Exp | ‡185 |
| Inspiration | 63¼ |
| Internat. S. & R. | ‡124 |
| Kerr Lake | 4⅝ |
| La Rose | 3¾ |
| McKinley-Dar-Sa. | 1⅝ |
| Min. Co. of A. new | 4¾ |
| Moneta Porc | ‡.17 |
| Mont. Shoshone | ‡.04 |
| Nev. Utah M. & S. | 1/16 |
| New Baltic | 3½ |
| Nipissing Mines | 8 |
| Ohio Copper | 1⅛ |
| Pacific Sm. & M. | 3/16 |
| Precious Metals | ‡1¾ |
| Ray Central | 1⅛ |
| Red Warrior | ‡1½ |
| South Utah M.& S. | ½ |
| Standard Oil | 600 |
| Stewart | .97 |
| Tonopah | 5⅛ |
| Tonopah Ex | .85 |
| Tri-Bullion | 5/16 |
| Tularosa | ⅜ |
| Union Mines | ¼ |
| Yukon Gold | 3¾ |

LONDON Aug. 23

| Name of Com. | Clg. |
|---|---|
| Camp Bird | £1 9s 4½d |
| Dolcres | 1 10 0 |
| El Oro | 1 3 0 |
| Esperanza | 1 16 3 |
| Mexico Mines | 7 1 3 |
| Oroville | 0 5 9 |
| Stratton's Ind. | 0 1 10½ |
| Tomboy | 0 19 0 |

BOSTON EXCH. Aug. 22

| Name of Comp. | Clg. |
|---|---|
| Adventure | 5 |
| Algomah | 5¾ |
| Allouez | 24 |
| Am. Zinc | 22¾ |
| Arcadian | 2 |
| Arizona Com | 2¼ |
| Atlantic | ‡6 |
| Bonanza | .50 |
| Boston & Corbin | 5 |
| Butte & Balak | 3½ |
| Calumet & Ariz | 49¼ |
| Calumet & Hecla | 410 |
| Centennial | 9 |
| Con. Mercur | 05 |
| Copper Range | 55 |
| Daly-West | 5 |
| East Butte | 10⅝ |
| Franklin | 8⅛ |
| Granby | 28½ |
| Hancock | 20 |
| Hedley Gold | 15⅜ |
| Helvetia | 1 |
| Indiana | 8 |
| Isle Royale | 13½ |
| Keweenaw | 2⅛ |
| Lake | 25⅜ |
| La Salle | 3½ |
| Mass | 6 |
| Michigan | 2 |
| Mohawk | 40 |
| New Arcadian | 2 |
| North Butte | 24¾ |
| North Lake | 6 |
| Ojibway | 5¼ |
| Old Dominion | 38 |
| Osceola | 90 |
| Parrot | 9¼ |
| Quincy | 66 |
| Shannon | 9 |
| Shattuck-Ariz | 15¾ |
| Superior | 24 |
| Superior & Bost. | 4⅛ |
| Tamarack | 26 |
| Trinity | 3½ |
| Tuolumne | 4 |
| U. S. Smelting | 33¼ |
| U. S. Smelt'g, pf. | 47 |
| Utah Apex | 2¼ |
| Utah Con | 13¼ |
| Victoria | 2 |
| Winona | 6 |
| Wolverine | 100 |
| Wyandot | 1 |

BOSTON CURB Aug. 15

| Name of Comp. | Last |
|---|---|
| Ahmeek | 155 |
| Bingham Mines | 1 |
| Boston Ely | 1⅜ |
| Boswycolo | 10 |
| Cactus | 10 |
| Calaveras | 1 |
| United Verde Ext. | .50 |
| Chief Cons | 70 |
| Corbin | 2 |
| Cortez | 1 1/16 |
| Crown Reserve | 3 |
| First Nat. Cop. | 1 |
| Live Oak | 21 |
| Majestic | 47 |
| Mazatan | ‡1 |
| Nat'l Mine & Ex. | 10 |
| Nevada-Douglas | 2⅜ |
| Oneco | 1½ |
| Raven Copper | 31 |
| Rhode Island Coal | 2½ |
| San Antonio | ‡3½ |
| South Lake | 5½ |
| Trethewey | ‡.79 |
| United Zinc, pfd. | ‡2 |
| Vulture | 5½ |
| Yuma | ‡.02 |

‡Last quotation.